TITLE	STEAM TURBINE INSPETION & TEST RECORD	DOC.No. LGTPR-8121-2034-2	REV. 0
CUSTOMER	LG Engineering & Construction Corp.	COMPLETE IN WITH COVER 80	SHEETS
FINAL USER	Turkish Petroleum Refineries Corp.		
PROJECT	Tuprus Izmmur Refinery DHP Project	SERVICE	Recycle Compressor
JOB No.	7020	EBARA SER.No	R021570803
ITEM No.	TC-9901	MODEL/EQUIP	SRV-5DF SET 1

TO	SET
CUS.	1C

REV.	PAGE	DATE	APP'D	BY
5				
4				
3				
2				
1				

ISSUED BY QUALITY ASSURANCE DEPT.
OF SODEGAURA PLANT

APPROVED BY Nov. 6, '03

CHECKED BY

PREPARED BY Nov.-6-2003

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

STEAM TURBINE INSPECTION REPORT

ITEM NO. : TC-9901

EBR JOB NO,: R021570803

EBR MODEL : SRV-5DF

CONTENTS

材料試験成績表
MATERIAL TEST REPORT

客先 Messrs. Elliott Ebara Turbomachinery Corporation

Report No. F03-0488

Date 2003- 4-14

納入先 Client

材質 Material ASTM A217M-01 WC6

溶解番号 Charge No. 3A062

仕様書番号 Spec. No. 〔EBARA STD.〕 SMPS-EC-E07 Rev. 6

工事番号 Works No.	注文番号 P/O No.	品名 Article	数量 Quantity	照合番号 Ident. No.	単重 S. Weight kgs	図番 Dwg. No.	製造番号 Manuf. No.
R021570803	CD79657	JSRV-5DF STM END CASING (UPPER)	1	3A062	2000	ES-8621714-1	H322-329

引張試験 Tension Test — 試験片 Test piece ASTM A370 Dia. 12.5mm G.L. 50mm

	耐力 Yield St. (Mpa)	降伏点 Yield Pt. (Mpa)	引張強度 Tensile St. (Mpa)	伸び Elongation (%)	絞り Reduction of Area (%)
規格 Spec.	min 275	- -	485 655	min 20	min 35
実績 Result.	398	-	541	30	70

衝撃試験 Impact Test — 試験片 Test piece – 温度 Temp. –

	Ave. (J)	Each (J)		
規格 Spec.	- -	- -		
実績 Result.	-	-	-	-

硬度試験 Hardness Test

	HB
規格 Spec.	- -
実績 Result.	-

熱処理 Heat Treatment

Nor.
950～960℃ X 6.0h A.C
Tem.
715～725℃ X 6.0h A.C

R021570803
SRV-5
Item No.: CT-9901
Casing
Part Name: Steam end casing (Upper)

備考 Remarks

DT : Acceptable
VT : Acceptable

化学成分 Chemical Composition % / 不純物元素 Impurities %

	C	Si	Mn	P	S	Cr	Mo	-	-	-	Cu	Ni	W	-	Total
規格 Spec.	0.05 0.20	max 0.60	0.50 0.80	max 0.040	max 0.045	1.00 1.50	0.45 0.65	- -	- -	- -	max 0.50	max 0.50	max 0.10	- -	max 1.00
実績 Result.	0.14	0.44	0.65	0.016	0.006	1.14	0.48	-	-	-	0.03	0.19	0.01	-	0.23

試験機 Testing Machine No. T-79 OS 106
I-79 OS 52
H-2556

上記の通り検査の結果、指定の規格に合格している事を証明致します。
It is hereby certified that the above results are true and correct in every details.

コマツメタル株式会社 KOMATSU METAL LTD.

Certified by ______ Manager of Quality Assurance Dep.

Witnessed by ______ Date ______

Witnessed by ______ Date ______

INSPECTION-TEAM ☐WITNESSED ☒REVIEWED
LG E&C Y. Tsutsumi Aug 6, '03

ELLIOTT EBARA GROUP ☐Witnessed ☒Reviewed
EETC Q.C Dept.

NON-DESTRUCTIVE EXAMINATION RECORD
非 破 壊 試 験 記 録

Record No. 記録No. KNF－329

Time of Exam. 試験時期 Final 最終

Issued Date 発行日 2003－4－14

Customer 客 先: Ebara Corporation	P.O. No. 注文番号: CD79657
	Spec. No 仕様書番号: 〔EBARA STD.〕 SMPS－EC－C07 Rev. 6
Customer's Project No. 客先工番: R021570803	KOMATSU work No 製 番: H322－329
Part Name 部品名: JSRV－5DF STM END CASING (UPPER)	Identification No 識別番号: 3A062
Drawing No. 図 番: ES－8621714－1	Charge No. 溶解番号: 3A062
Material 材 質: ASTM A217M WC6	Surface Condition 表面状態: Casted, Ground, Machined

MT記録

Procedure No. 要領書番号: 〔EBARA STD.〕 SPS－1002－20	Prod Spacing プロッド間隔: 150mm
Direction of Magnetizing 磁化方向: Two Direction at Right Angle	Current 磁化電流: 800A Time 通電時間: Continuous sec 秒
Magnetic Particle 磁粉 (タイプ及び色): Marktec LY－1500 (Wet) ☐ Grey 灰色 ■ Fluorescent	Area to be examined 探傷箇所: All Surface
Ref. Test Piece 試 験 片: JIS A1－30／100	Acceptance std. 合格基準: SPS－1002－20 Sec. 5 (FES－P－10178 Table 5)
Control No. 機器No.: NT－22 Calibration 有効日: 2003－7－23	Judgement 判 定: ■ Acceptable 合格 ☐ Not Acceptable 不合格
Magnetizing Method 磁化方法: Prod	

PT記録

Procedure No. 要領書番号: JIS Z 2343 (1992)	Drying Method 乾燥法: Dried Naturally Time 時間: 15 min. 分
Applying Method of Penetrant Penet. Time 浸透液の適用法: Spray 20 min. 分	Testing Temp. 試験温度: 15 ℃ Developing Time 現像時間: 7～30 min. 分
PT Medium 材 料 / Trade Name 商品名 / Lot No. ロットNo.	Area to be examined 探傷箇所: Impossible Zone of MT
Penetrant 浸透液: Marktec UP－GⅢ －	Acceptance std. 合格基準: SPS－1002－20 Sec. 5 (FES－P－10178 Table 6)
Solvent 洗浄液: Water Sray －	Judgement 判 定: ■ Acceptable 合格 ☐ Not Acceptable 不合格
Developer 現像液: Marktec UD－ST －	

VT記録

Procedure No. 要領書番号	Sketch スケッチ: R021570803 SRV-5 Item No.: CT-9901 Casing Part Name: Steam end casing (Upper)
Area to be examined 探傷箇所	
Acceptance std. 合格基準	
Judgement 判 定: Acceptable ☐ 合格 Not Acceptable ☐ 不合格	

CUSTOMER 客 先	コマツメタル株式会社 Komatsu Metal Ltd
Approved by 承 認: INSPECTION TEAM ☐WITNESSED ☒REVIEWED LG E&C Y. Tsutsumi Aug. 6, '07 Date	Approved by 承 認 H. KITAGAWA (NDI－II) Date 2003－4－10
Approved by 承 認 Date	Judged by 判 定 R. HASHIMOTO (NDI－II) Date 2003－4－10
Approved by 承 認 ELLIOTT ☐Witnessed ☑Reviewed Date	Examined by 試 験 R. HASHIMOTO (NDI－II) Date 2003－4－10

EETC Q.C Dept.

材料試験成績表
MATERIAL TEST REPORT

客先 Messrs. Elliott Ebara Turbomachinery Corporation

Report No. F03-0489

Date 2003- 4-14

納入先 Client

材質 Material ASTM A217M-01 WC6

溶解番号 Charge No. 3K045

仕様書番号 Spec. No. 〔EBARA STD.〕 SMPS-EC-E07 Rev. 6

工事番号 Works No.	注文番号 P/O No.	品名 Article	数量 Quantity	照合番号 Ident. No.	単重 S. Weight kgs	図番 Dwg. No.	製造番号 Manuf. No.
R021570803	CD79658	JSRV-5DF STM END CASING (LOWER)	1	3K045	880	ES-8621714-2	H322-330

引張試験 Tension Test — 試験片 Test piece ASTM A370, Dia. 12.5mm, G.L. 50mm

衝撃試験 Impact Test — 試験片 Test piece –, 温度 Temp. –

	耐力 Yield St. (Mpa)	降伏点 Yield Pt. (Mpa)	引張強度 Tensile St. (Mpa)	伸び Elongation (%)	絞り Reduction of Area (%)	Impact Ave. (J)	Impact Each (J)			硬度試験 Hardness Test HB
規格 Spec.	min 275	– –	485 655	min 20	min 35	– –	– –			– –
実績 Result.	359	–	522	32	66	–	–	–	–	–

熱処理 Heat Treatment

Nor.
950～960℃ X 6.0h A.C
Tem.
715～725℃ X 6.0h A.C

R021570803
SRV-5
Item No.; CT-9901
Casing
Part Name: Steam end casing (Lower)

備考 Remarks

DT : Acceptable
VT : Acceptable

化学成分 Chemical Composition % / 不純物元素 Impurities %

	C	Si	Mn	P	S	Cr	Mo	–	–	–	Cu	Ni	W	–	Total
規格 Spec.	0.05 0.20	max 0.60	0.50 0.80	max 0.040	max 0.045	1.00 1.50	0.45 0.65	–	–	–	max 0.50	max 0.50	max 0.10	–	max 1.00
実績 Result.	0.16	0.45	0.57	0.019	0.004	1.13	0.47	–	–	–	0.03	0.22	0.01	–	0.26

試験機 Testing Machine No. T-79 OS 106
I-79 OS 52
~~II-2666~~

上記の通り検査の結果、指定の規格に合格している事を証明致します。
It is hereby certified that the above results are true and correct in every details.

コマツメタル株式会社 KOMATSU METAL LTD.

Witnessed by ________ Date ________

Witnessed by LG E&C Date

INSPECTION TEAM ☐WITNESSED ☒REVIEWED
Y. Tsutsumi Aug. 6. '03

ELLIOTT EBARA GROUP ☐Witnessed ☒Reviewed
EETC Q.C Dept.

Certified by ________
Manager of Quality Assurance Dep.

5

NON-DESTRUCTIVE EXAMINATION RECORD
非 破 壊 試 験 記 録

Record No. 記録No. KNF−330

Time of Exam. 試験時期 Final 最終

Issued Date 発行日 2003−4−14

Customer 客 先: Ebara Corporation	P.O. No. 注文番号: CD79658
	Spec. No 仕様書番号: 〔EBARA STD.〕 SMPS−EC−C07 Rev. 6
Customer's Project No. 客先工番: R021570803	KOMATSU work No 製 番: H322−330
Part Name 部品名: JSRV−5DF STM END CASING (LOWER)	Identification No 識別番号: 3K045
Drawing No. 図 番: ES−8621714−2	Charge No. 溶解番号: 3K045
Material 材 質: ASTM A217M WC6	Surface Condition 表面状態: Casted, Ground, Machined

MT記録

Procedure No. 要領書番号: 〔EBARA STD.〕 SPS−1002−20	Prod Spacing プロッド間隔: 150mm
Direction of Magnetizing 磁化方向: Two Direction at Right Angle	Current 磁化電流: 800A Time 通電時間: Continuous sec 秒
Magnetic Particle 磁粉 (タイプ及び色): Marktec LY−1500 (Wet) ☐ Grey 灰色 ■ Fluorescent	Area to be examined 探傷箇所: All Surface
Ref. Test Piece 試 験 片: JIS A1−30/100	Acceptance std. 合格基準: SPS−1002−20 Sec. 5 (FES−P−10178 Table 5)
Control No. 機器No.: NT−22 Calibration 有効日: 2003−7−23	Judgement 判 定: Acceptable ■ 合格 Not Acceptable ☐ 不合格
Magnetizing Method 磁化方法: Prod	

PT記録

Procedure No. 要領書番号: JIS Z 2343 (1992)	Drying Method 乾燥法: Dried Naturally Time 時間: 15 min. 分
Applying Method of Penetrant Penet. Time 浸透液の適用法: Spray 20 min. 分	Testing Temp. 試験温度: 15 ℃ Developing Time 現像時間: 7〜30 min. 分
PT Medium 材 料 / Trade Name 商品名 / Lot No. ロットNo.	Area to be examined 探傷箇所: Impossible Zone of MT
Penetrant 浸透液: Marktec UP−GIII / −	Acceptance std. 合格基準: SPS−1002−20 Sec. 5 (FES−P−10178 Table 6)
Solvent 洗浄液: Water Sray / −	Judgement 判 定: Acceptable ■ 合格 Not Acceptable ☐ 不合格
Developer 現像液: Marktec UD−ST / −	

VT記録

Procedure No. 要領書番号	Sketch スケッチ: R021570803 SRV-5 Item No.: CT-9901 Casing Part Name: Steam end casing (Lower)
Area to be examined 探傷箇所	
Acceptance std. 合格基準	
Judgement 判 定: Acceptable ☐ 合格 Not Acceptable ☐ 不合格	

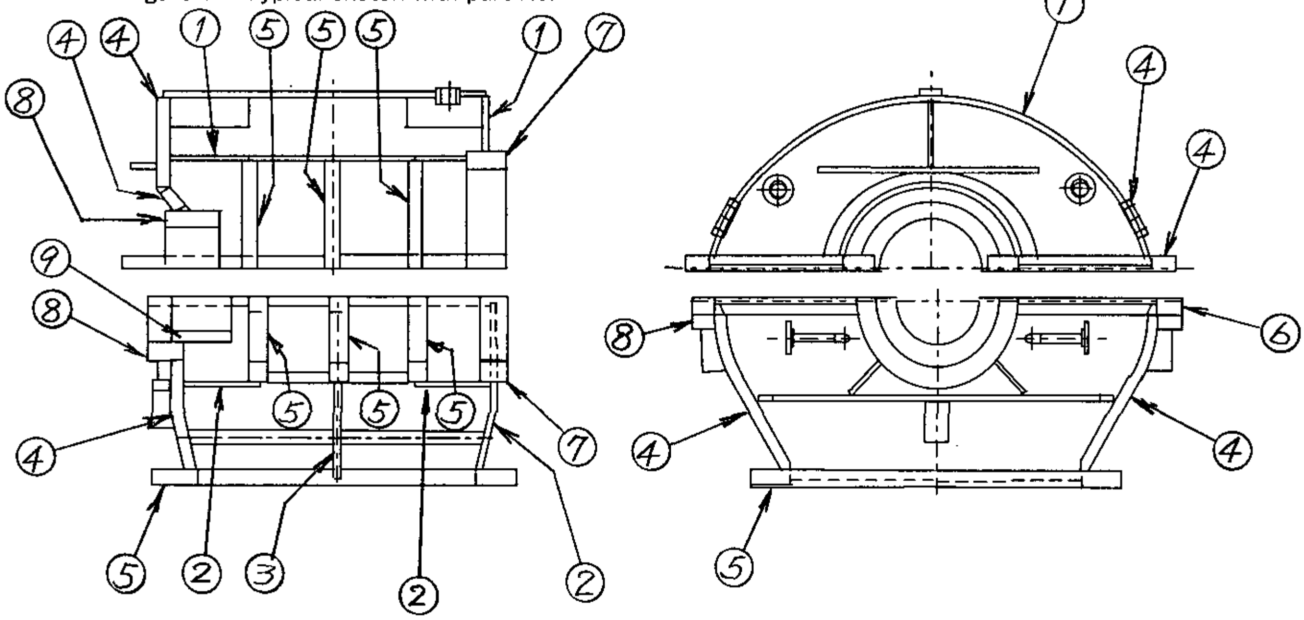
CUSTOMER 客 先	コマツメタル株式会社 Komatsu Metal Ltd
Approved by 承 認: INSPECTION TEAM ☐WITNESSED ☒REVIEWED Date	Approved by 承 認 H. KITAGAWA Date (NDI−II) 2003−4−10
Approved by 承 認: LG E&C Y. Butsumi Aug. 6, '03 Date	Judged by 判 定 R. HASHIMOTO Date (NDI−II) 2003−4−10
Approved by 承 認: ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed Date	Examined by 試 験 R. HASHIMOTO Date (NDI−II) 2003−4−10

EETC Q.C Dept.

Inspection Activity		
Subvendor	Ebara	Customer
		P

SUBJECT	STEAM TURBINE CASING / TABULATION OF MATERIALS		
EBARA SER. No. R021570803	MODEL SRV-5DF	ITEM No. CT-9901	
MACHINE No –		Exhaust end casing	

■ Figure : Typical sketch with part No.



■ Table : Material List

Part No.	Q'ty	Material	Charge or Plate No.	Mill Maker	Ebara I.D. No.	Remarks
①	1	ASTM A516 Gr.60	63609030Z	NIPPON STEEL CORP.	06ZA	t=19
②	↕	↕	8Z7430-3	↕	15ZA	t=19
③			105987-1		001B	t=38
④			169856-1		459B	t=50
⑤			0Z4908-1		460B	t=75
⑥			4Z863Z-1		096A	t=100
⑦			167151-1		461B	t=130
⑧			0Z173Z-1		073B	t=178
⑨	1	ASTM A516 Gr.60	0ZZ149-1	NIPPON STEEL CORP.	058B	t=ZZ9
⑩						

■ Note Reference item number of quality plan : A04

TO	SET

	Approved (QA dept.)	Checked (QA dept.)	Prepared	Customer / Inspector
by	[signature]	–	T. Tafel [signature]	INSPECTION TEAM ☐WITNESSED ☒REVIEWED IG E&C [signature]
Date	Jul. 16, '03		Jul.-16-2003	Aug. 6, '03

新日本製鐵株式會社
Nippon Steel Corporation

鋼材検査証明書
INSPECTION CERTIFICATE

本社 HEAD OFFICE: 〒100-8071 東京都千代田区大手町二丁目6番3号 2-6-3, OTEMACHI, CHIYODA-KU, TOKYO 100-8071, JAPAN
君津製鐵所 KIMITSU WORKS: 〒299-1141 千葉県君津市君津1番地 1, KIMITSU, KIMITSU-CITY, CHIBA-PREF, 299-1141 JAPAN

注文者 SHIPPER: ITOCHU
注文者照合番号 REFERENCE No.: 303-1181F005
契約番号 CONTRACT No.: 1-106-H1-1-7-1539
商品名 COMMODITY: STEEL PLATE
規格 SPECIFICATION: ASTM A516-86 GRADE 60-SR
文書番号 DOCUMENT No.:
需要家 CUSTOMER: EBARA CORP.

証明書番号 CERTIFICATE No.: P-65492 頁 PAGE: 1E
発行年月日 DATE OF ISSUE: 2001-08-30
1001 24M**B3***
*****T****
需要家管理番号 CUSTOMER'S CONTROL No.: R001367101 E2041P06Q1 E04

寸法 DIMENSION MM	員数 QUANTITY	質量 MASS KG	製鋼番号 CAST No. / 試験番号 TEST No.	製品番号 PLATE No.	LOCATION ORIENTATION GL ※1 ※2	引張試験 TENSILE TEST 耐力降伏点 YS YP 0.2% N/MM2 KSI	引張強さ TS	伸び EL %	% ※3	BEND TEST ※4	LOCATION ORIENTATION ※1	SUB SIZE ※5	衝撃試験 IMPACT TEST 平均値 AVG	個々値 EACH
~~01~~ ~~9X1000X3000 060A~~	~~1~~	~~212~~	~~G6308 / 69753~~	~~TESTED-PL / 636090101~~	~~TC~~	~~361 / 52~~	~~482 / 67~~	~~28~~						
~~02~~ ~~10X1220X4000 061A~~	~~1~~	~~837~~	~~G7308 / 78419~~	~~TESTED-PL / 636090201~~	~~TC~~	~~378 / 55~~	~~474 / 69~~	~~26~~						
03 19X2000X6000 062A	1	1790	G3208 / 78587	636090302	TC	317 / 46	445 / 65	31						
~~05~~ ~~10X1600X8000 064A~~	~~1~~	~~1343~~	~~G3208 / 76587~~	~~636090501~~	~~TC~~	~~317 / 46~~	~~445 / 65~~	~~31~~						
TOTAL	4	4182												

化学成分 CHEMICAL COMPOSITION %	C ×100	Si ×100	Mn ×100	P ×1000	S ×1000	Cu ×100	Ni ×100	Cr ×100	Mo ×100	Nb ×100	V ×100	TAl ×100	Ceq 1 ×100	機械的性質 CONDITION OF SUPPLY
※6	×1000	×1000	×1000	TE1 ×100	TE2 ×100	×100	×10000	×10000	×100		Pcm ×100	Sol. Al ×100	Ceq 2 ×100	※7
~~15 20 104 10 4 1 1 2 0 1 037~~				~~2~~	~~4~~									
~~18 21 103 10 3 1 1 2 0 1 033~~				~~2~~	~~4~~									
15 20 102 19 4 1 2 2 0 1 031				2	5									
~~15 20 102 19 4 1 2 2 0 1 031~~				~~2~~	~~5~~									

HEAT TREATMENT.
TEST SPECIMEN SR: 625CX360MIN.
LADLE TE1 = CR+MO
LADLE TE2 = CU+NI+CR+MO
VISUAL & DIMENSIONAL INSPECTION : ACCEPTABLE

SER. NO.	R021570803
ITEM NO.	CT-9901
PARTNO.	①
TYPE :	SRV-5DF

ELLIOTT. EBARA GROUP ☐Witnessed ☑Reviewed
EETC Q.C Dept. Y. Yoshida

注釈 NOTES
※1 Location Orientation 位置・方向, T:頂部 Top, B:底部 Bottom, L:圧延方向 Longitudinal, C:直角方向 Transverse, Z:板厚方向 Through Thickness, R:45° 方向 45Deg. to the Longitudinal Axis
※2 GL 標点距離 Gage Length, A:50mm 平形試験片 Rectangular, B:50mm 丸形試験片 Round, C:70mm 平形試験片 Rectangular, D:70mm 丸形試験片 Round, E:80mm 平形試験片 Rectangular, F:80mm 丸形試験片 Round, G:200mm, H:2", I:8", J:5.65√So, K:4√So
※3 RA:絞り Reduction of Area, YR:降伏比 Yield Ratio, ※4 A:合格 Acceptable, ※5 2:2.5mm, 3:3.3mm, 4:3.33mm, 5:5.0mm, 6:6.67mm, 7:7.5mm, 8:6.7mm, 9:製品板厚 PlateThickness, ※6 P:製品分析 Product Analysis
※7 N:焼準 Normalized, Q:焼入れ Quenched, T:焼戻し Tempered, CR:Controlled Rolled, NIC:NIC Process/TMC Process, CLC:CLC Process/TMC Process, AR:As Rolled, TMR:TMR Process/TMC Process
SH:延性破面率 Shear Fracture, CF:~~060A~~ Brittle Fracture, LE:横膨出 Lateral Expansion, AGS:オーステナイト粒度 Austenite Grain Size, FGS:フェライト粒度 Ferrite Grain Size, SR:Stress Relieved/Post Weld Heat Treatment
温度 Temperature C: °C F: °F

上記注文品は御指定の規格または仕様に従って製造され、その要求事項を満足していることを証明します。

EBARA ~~061A~~ 062A ~~061A~~ ~~065A~~

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN MADE IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

INSPECTION TEAM
☐WITNESSED ☒REVIEWED
LG E&C G. Tsutsumi Aug 6, '03

01.9.10 野崎

Y. Yoshida
君津製鐵所厚板管理グループリーダー
MANAGER, INSPECTION
KIMITSU WORKS

用紙区分：厚板

8

新日本製鐵株式會社
NIPPON STEEL CORPORATION

超音波探傷検査証明書
ULTRASONIC EXAMINATION CERTIFICATE

本　　社：〒100-8071　東京都千代田区大手町二丁目６番３号
HEAD OFFICE　2-6-3, OTEMACHI, CHIYODA-KU, TOKYO 100-8071, JAPAN
君津製鐵所：〒299-1141　千葉県君津市君津１番地
KIMITSU WORKS　1, KIMITSU, KIMITSU-CITY, CHIBA-PREF, JAPAN

証明書番号 CERTIFICATE No.：866- 1
発行年月日 DATE OF ISSUE：2001-08-30

需要家 CUSTOMER：EBARA CORP.
注文者 SHIPPER：ITOCHU
契約番号 CONTRACT No.：1-106-H1-1-7-1539
規格 SPECIFICATION：ASTM A516-86 GRADE 60-SR
文書番号 DOCUMENT No.：

探傷器 FLAW DETECTOR：TOKIMEC SM90
試験方法 TESTING METHOD：DIRECT CONTACT METHOD
接触媒質 COUPLANT：WATER
周波数 FREQUENCY：5MHZ
探傷感度 SENSITIVITY：ASTM A435
探傷箇所 SCANNING：AS PER CUSTOMER'S SPECIFICATION

探触子 PROBE：5Q30N
判定基準 CRITERIA：AS PER ASTM A435
技術者及びレベル EVALUATOR & LEVEL：S. SAITOH　LEVEL Ⅰ Ⅱ

寸法 DIMENSION (MM)	製鋼番号 CAST No.	製品番号 PLATE No.	検査成績 RESULT	備考 REMARKS
~~9X1000X3000~~	~~G6308~~	~~636090101~~	~~ACCEPTABLE~~	~~060A~~
~~19X1220X4600~~	~~G7368~~	~~636090201~~	~~ACCEPTABLE~~	~~061A~~
19X2000X6000	G3208	636090302	ACCEPTABLE	062A
~~19X1500X6000~~	~~G3208~~	~~636090501~~	~~ACCEPTABLE~~	~~064A~~
	TOTAL	4		

備考欄に＊印がある場合は、別紙・超音波探傷検査結果を参照下さい。

IN CASE THAT AN ASTERISK(*) IS DENOTED IN THE REMARKS COLUMN PLEASE REFER TO ULTRASONIC EXAMINATION REPORT ENCLOSED HEREIN.

060A
061A
062A
064A
~~065A~~

EBARA I.D.No.

SER. NO.	ROZ1570803
ITEM NO.	CT-9901
PARTNO.	①
TYPE ：	SRV-5DF

ELLIOTT EBARA GROUP　☐Witnessed ☑Reviewed
EETC Q.C Dept. T. Tokita

01.9.10 野崎

検査員：SURVEYOR TO
LG E&C
INSPECTION TEAM
☐WITNESSED ☒REVIEWED
T. Tsutsumi Aug 6, '03

上記注文品は超音波探傷検査を実施した結果、御指定の基準に合格したことを証明します。
WE HEREBY CERTIFY THAT THE PLATES DESCRIBED HEREIN HAVE BEEN ALL ACCEPTABLE ON THE ULTRASONIC EXAMINATION IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

Y. Yoshida
君津製鐵所　厚板管理グループリーダー
MANAGER, INSPECTION
KIMITSU WORKS

用紙区分：厚板

注文者 SHIPPER: ITOCHU MARUBENI
注文者照合番号 REFERENCE No.: 002-1181J0A0
契約番号 CONTRACT No.: 1-106-H1-1-0-1539
商品名 COMMODITY: STEEL PLATE
規格 SPECIFICATION: ASTM A516-90 GRADE 60
文書番号 DOCUMENT No.:
需要家 CUSTOMER: EBARA CORP.

新日本製鐵株式會社
Nippon Steel Corporation
鋼材検査証明書
INSPECTION CERTIFICATE

本社 HEAD OFFICE: 〒100-8071 東京都千代田区大手町二丁目6番3号 2-6-3, OTEMACHI, CHIYODA-KU, TOKYO, 100-8071, JAPAN
名古屋製鐵所 NAGOYA WORKS: 〒476-8686 愛知県東海市東海町五丁目3番地 5-3, TOKAI-MACHI, TOKAI-CITY, AICHI-PREF., 476-8686, JAPAN

証明書番号 CERTIFICATE No.: M117749 頁 PAGE: 1E
発行年月日 DATE OF ISSUE: 2001-11-14
E2041P06Q2 T....
01 D AE04 ....
需要家管理番号 CUSTOMER'S CONTROL No.: R001600302 24M..B3.....

寸法 DIMENSION MM	員数 QUANTITY	質量 MASS KG	製鋼番号 CAST No. / 試験番号 TEST No.	製品番号 PLATE No.	LOCATION ORIENTATION ※1 ※2	引張試験 TENSILE TEST 耐力 降伏点 YS 0.2% KSI N/MM2	引張強さ TS	伸び EL %	% ※3	BEND TEST ※4	LOCATION ※1	ORIENTATION ※1	SUB SIZE ※5	衝撃試験 IMPACT TEST 平均値 AVG	個々値 EACH	化学成分 CHEMICAL COMPOSITION % ※6 C X100 X1000	Si X100	Mn X100	P X1000	S X1000	Cu X100	Ni X100	Cr X100	Mo X100	Nb X100 X1000	V X100 X1000	T.Al X100 X1000	Ceq1 X100	Ceq3 X100	Sol.Al X1000	Ceq2 X100	供給状態 CONDITION OF SUPPLY ※7
SMPS-EC-R06	~~02~~		~~NK0320~~			~~39.3~~	~~61.1~~									~~16~~	~~21~~	~~95~~	~~17~~	~~5~~	~~1~~	~~3~~	~~3~~	~~0~~	~~0~~	~~02~~	~~13~~	~~3~~			~~3~~
~~19X1220X4800~~ ~~150A~~	~~1~~	~~837~~	~~91519~~	~~427818-2~~	~~BCI~~	~~271~~	~~421~~	~~33~~											~~3~~		~~7~~									
SMPS-EC-R06	~~03~~		~~NK9822 TESTED-PL~~			~~40.6~~	~~63.2~~									~~16~~	~~21~~	~~95~~	~~16~~	~~4~~	~~4~~	~~2~~	~~2~~	~~0~~	~~0~~	~~03~~	~~83~~	~~3~~			~~3~~
~~19X2000X6000~~ ~~151A~~	~~1~~	~~1790~~	~~91362~~	~~827430-1~~	~~BCI~~	~~280~~	~~436~~	~~30~~											~~2~~		~~8~~									
SMPS-EC-R06 04	1	985	NK9822 91362	827430-3	BCI	40.6 280	63.2 436	30								16	21	95	16 2	4	4 8	2	2	0	0	03	83	3			3
19X1500X4400 152A																														
SMPS-EC-R06 ~~05~~			~~NK9822~~			~~40.6~~	~~63.2~~									~~16~~	~~21~~	~~95~~	~~16~~	~~4~~	~~4~~	~~2~~	~~2~~	~~0~~	~~0~~	~~03~~	~~83~~	~~3~~			~~3~~
~~19X1500X6000~~ ~~153A~~	~~1~~	~~1343~~	~~91362~~	~~827430-2~~	~~BCI~~	~~280~~	~~436~~	~~30~~											~~2~~		~~8~~									
TOTAL	4	4955																												

HEAT TREATMENT
TEST SPECIMEN SR : 1157F (625C) X 360MIN.
VISUAL & DIMENSIONAL INSPECTION : ACCEPTABLE
CAST CEQ1 = C+MN/6+ (NI+CU) /15+ (CR+MO+V) /5
CAST TE1 = CR + MO
CAST TE2 = CU + NI + CR + MO

SER. NO.	R021570803
ITEM NO.	CT-9901
PART NO.	②
TYPE	SRV-5DF

ELLIOTT ECARA GROUP ☐Witnessed ☑Reviewed
EETC Q.C Dept.

INSPECTION TEAM
☐WITNESSED ☒REVIEWED
LG E&C Y. Tantawi Aug. 6 '03

注釈 NOTES
※1 Location Orientation 位置・方向, T: 頭部 Top, B: 底部 Bottom, L: 圧延方向 Longitudinal, C: 直角方向 Transverse, Z: 板厚方向 Through Thickness, R: 45°方向 45Deg. to the Longitudinal Axis
※2 GL 標点間距離 Gage Length, A: 50mm平形試験片 Rectangular, B: 50mm丸形試験片 Round, C: 70mm平形試験片 Rectangular, D: 70mm丸形試験片 Round, E: 80mm平形試験片 Rectangular, F: 80mm丸形試験片 Round, G: 200mm, H: 2", I: 8", J: 5.65√So, K: 4√So
※3 RA: 絞り Reduction of Area, YR: 降伏比 Yield Ratio. ※4 A: 合格 Acceptable. ※5 2: 2.5mm, 3: 3.3mm, 4: 3.33mm, 5: 5.0mm, 6: 6.67mm, 7: 7.5mm, 8: 6.7mm, 9: 製品板厚 Plate Thickness. ※6 P: 製品分析 Product Analysis
※7 N: 焼準 Normalized, Q: 焼入れ Quenched, T: 焼戻し Tempered, CR: Controlled Rolled, NIC: NIC Process/TMC Process, CLC: CLC Process/TMC Process, L: Intermediate Heat Treatment, AR: As Rolled
SH: 延性破面率 Shear Fracture, CF: 脆性破面率 Crystallinity Fracture, LE: 横膨出 Lateral Exoansion, AGS: オーステナイト粒度 Austenite Grain Size, FGS: フェライト粒度 Ferrite Grain Size, SR: Stress Relieved/Post Weld Heat Treatment
温度 Temperature ☐☐☐C: ☐☐☐°C ☐☐☐F: ☐☐☐°F

EBARA I.D.No. ~~150A~~ ~~151A~~ 152A ~~153A~~

上記注文品は御指定の規格または仕様に従って製造され、その要求事項を満足していることを証明します。

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN MADE IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

'01.12.11

M. Tanaka
名古屋製鐵所 厚板商品管理グループ
MANAGER, INSPECTION
NAGOYA WORKS

N16-1 (2) Rev. 9

新日本製鐵株式會社
Nippon Steel Corporation
本　社：〒100-8071 東京都千代田区大手町二丁目６番３号
HEAD OFFICE：2-6-3, OTEMACHI, CHIYODA-KU, TOKYO, 100-8071, JAPAN
名古屋製鐵所：〒476-8686 愛知県東海市東海町五丁目３番地
NAGOYA WORKS：5-3, TOKAI-MACHI, TOKAI-CITY, AICHI-PREF., 476-8686, JAPAN

超音波探傷検査証明書
ULTRASONIC EXAMINATION CERTIFICATE

証明書番号 CERTIFICATE No.: M117749
発行年月日 DATE OF ISSUE: 2001-11-14

需要家 CUSTOMER: EBARA CORP.
注文者 SHIPPER: ITOCHU MARUBENI
契約番号 CONTRACT No.: R001600302
1-106-H1-1-0-1539

探傷器 FLAW DETECTOR: TOKIMEC SM90D
試験方法 TESTING METHOD: LOCAL IMMERSION METHOD
接触媒質 COUPLANT: WATER
周波数 FREQUENCY: 5 MHZ
探傷感度 SENSITIVITY: BG : 75%
探傷箇所 SCANNING: AS PER ASTM A435

探触子 PROBE: 5C25I
判定基準 CRITERIA: AS PER ASTM A435
技術者及びレベル EVALUATOR & LEVEL: O. SUDA, LEVEL II

規格 SPECIFICATION: ASTM A516-90 GRADE 60
文書番号 DOCUMENT No.:

寸法 DIMENSION (MM)	製鋼番号 CAST No.	製品番号 PLATE No.	検査成績 RESULT	EBARA I.D.No.
~~SMPS-EC-R06 19.00 X 1220 X 4600~~	~~NK0320~~	~~427818-2~~	~~ACCEPTABLE~~	~~150A~~
~~SMPS-EC-R06 19.00 X 2000 X 6000~~	~~NK9822~~	~~827430-1~~	~~ACCEPTABLE~~	~~151A~~
SMPS-EC-R06 19.00 X 1500 X 4400	NK9822	827430-3	ACCEPTABLE	152A
~~SMPS-EC-R06 19.00 X 1500 X 6000~~	~~NK9822~~	~~827430-2~~	~~ACCEPTABLE~~	~~153A~~

備考 REMARKS

備考欄に＊印がある場合は，別紙・超音波探傷検査結果を参照下さい。

IN CASE THAT AN ASTERISK (*) IS DENOTED IN THE REMARKS COLUMN, PLEASE REFER TO ULTRASONIC EXAMINATION REPORT ENCLOSED HEREIN.

SER. NO.	R021570803
ITEM NO.	CT-9901
PARTNO.	②
TYPE :	SRV-5DF

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed
EETC Q.C Dept.

'01. 12. 11

検査員 SURVEYOR TO: LG E&C
INSPECTION TEAM ☐WITNESSED ☒REVIEWED
F. Tantsumi Aug. 6, '03

上記注文品は超音波探傷検査を実施した結果，御指定の基準に合格したことを証明します。

WE HEREBY CERTIFY THAT THE PLATES DESCRIBED HEREIN HAVE BEEN ALL ACCEPTABLE ON THE ULTRASONIC EXAMINATION IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

M. Tanaka
名古屋製鐵所 厚板商品管理グループ
MANAGER, INSPECTION
NAGOYA WORKS

N16-1 (3) Rev. 7

注文者 SHIPPER: ITOCHU MARUBENI
注文者照合番号 REFERENCE No.: 002-1181A090
契約番号 CONTRACT No.: 2-106-H1-1-2-1539
商品名 COMMODITY: STEEL PLATE
規格 SPECIFICATION: ASTM A516-90 GRADE 60
文書番号 DOCUMENT No.:
需要家 CUSTOMER: EBARA CORP.

新日本製鐵株式會社
Nippon Steel Corporation
鋼材検査証明書
INSPECTION CERTIFICATE

本社 HEAD OFFICE: 〒100-8071 東京都千代田区大手町二丁目6番3号 2-6-3, OTEMACHI, CHIYODA-KU, TOKYO, 100-8071, JAPAN
名古屋製鐵所 NAGOYA WORKS: 〒476-8686 愛知県東海市東海町五丁目3番地 5-3, TOKAI-MACHI, TOKAI-CITY, AICHI-PREF., 476-8686, JAPAN

証明書番号 CERTIFICATE No.: M203596 頁 PAGE: 1E
発行年月日 DATE OF ISSUE: 2002-03-22
需要家管理番号 CUSTOMER'S CONTROL No.: R010633702
E2041P06Q2 T....
01 D AE04 ....
24M..B3.....

寸法 DIMENSION MM	員数 QUANTITY	質量 MASS KG	製鋼番号 CAST No. / 試験番号 TEST No.	製品番号 PLATE No.	LOCATION ORIENTATION ※1	GL ※2	引張試験 TENSILE TEST 耐力 YS 降伏点 YP 0.2% KSI N/MM2	引張強さ TS KSI N/MM2	伸び EL %	% ※3	BEND TEST ※4	LOCATION ※1	ORIENTATION ※1	SUB SIZE ※5	衝撃試験 IMPACT TEST 平均値 AVG	個々値 EACH	化学成分 CHEMICAL COMPOSITION % C X100	Si X100	Mn X100	P X1000	S X1000	Cu X100	Ni X100	Cr X100	Mo X100	Nb X100	V X100	T. Al X100	Ceq.1 X100	熱処理の状態 CONDITION OF SUPPLY
																	※6 X1000	X1000	X1000	TE1 X100	X100	TE2 X100	X10000	X10000	X100		Ceq.3 X100	Sol.Al X1000	Ceq.2 X100	※7
SMPS-EC-R06	01		NP0304	TESTED-PL			41.2	61.4									15	19	96	12	4	1	2	4	0	0	0	38	32	
38X1600X6000		1	2864	09784 105987-1	B	C	284	423	36											4		7							
				HEAT TREATMENT																									
				TEST SPECIMEN SR : 1157F (625C) X 360MIN.																									
				VISUAL & DIMENSIONAL INSPECTION : ACCEPTABLE																									
				CAST CEQ1 = C+MN/6+(N1+CU)/15+(CR+MO+V)/5																									
				CAST TE1 = CR + MO																									
				CAST TE2 = CU + NI + CR + MO																									
TOTAL	1	2864																											

SER. NO.	R02L570803
ITEM NO.	CT-9901
PARTNO.	③
TYPE :	SRV-50F

ELLIOTT GROUP
☐ Witnessed
☑ Reviewed
EETC Q.C Dept.

注釈 NOTES
※1 Location Orientation 位置・方向, T: 頭部 Top, B: 底部 Bottom, L: 圧延方向 Longitudinal, C: 直角方向 Transverse, Z: 板厚方向 Through Thickness, R: 45°方向 45Deg. to the Longitudinal Axis
※2 GL 標点距離 Gage Length, A: 50mm平形試験片 Rectangular, B: 50mm丸形試験片 Round, C: 70mm平形試験片 Rectangular, D: 70mm丸形試験片 Round, E: 80mm平形試験片 Rectangular, F: 80mm丸形試験片 Round, G: 200mm, H: 2", I: 8", J: 5.65√So, K: 4√So
※3 RA: 絞り Reduction of Area, YR: 降伏比 Yield Ratio, ※4 A: 合格 Acceptable, ※5 2: 2.5mm, 3: 3.3mm, 4: 3.33mm, 5: 5.0mm, 6: 6.67mm, 7: 7.5mm, 8: 6.7mm, 9: 製品板厚 Plate Thickness, ※6 P: 製品分析 Product Analysis
※7 N: 焼準 Normalized, Q: 焼入れ Quenched, T: 焼戻し Tempered, CR: Controlled Rolled, NIC: NIC Process/TMC Process, CLC: CLC Process/TMC Process, L: Intermediate Heat Treatment, AR: As Rolled
SH: 延性破面率 Shear Fracture, CF: 脆性破面率 Crystallinity Fracture, LE: 横能出 Lateral Expansion, AGS: オーステナイト粒度 Austenite Grain Size, FGS: フェライト粒度 Ferrite Grain Size, SR: Stress Relieved/Post Weld Heat Treatment
温度 Temperature □□□C: □□□°C □□□F: □□□°F

INSPECTION TEAM
☐ WITNESSED ☒ REVIEWED
LG E&C
J. Tsutsumi Aug 6 '03
EBARA ID.No 001B

上記注文品は御指定の規格または仕様に従って製造され、その要求事項を満足していることを証明します。

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN MADE IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

検原品定 '02.4.2 野崎

M. Tanaka
名古屋製鐵所 厚板商品管理グループ
MANAGER, INSPECTION
NAGOYA WORKS

N16-1(2) Rev. 9

12

新日本製鐵株式會社
Nippon Steel Corporation

本社：〒100-8071東京都千代田区大手町二丁目6番3号
HEAD OFFICE：2-6-3, OTEMACHI, CHIYODA-KU, TOKYO, 100-8071, JAPAN
名古屋製鐵所：〒476-8686愛知県東海市東海町五丁目3番地
NAGOYA WORKS：5-3,TOKAI-MACHI,TOKAI-CITY,AICHI-PREF.,476-8686,JAPAN

超音波探傷検査証明書
ULTRASONIC EXAMINATION CERTIFICATE

証明書番号 CERTIFICATE No.：M203596　PAGE 1E
発行年月日 DATE OF ISSUE：2002-03-22

需要家 CUSTOMER：EBARA CORP.
注文者 SHIPPER：ITOCHU MARUBENI
契約番号 CONTRACT No.：R010633702
2-106-H1-1-2-1539
規格 SPECIFICATION：ASTM A516-90 GRADE 60
文書番号 DOCUMENT No.：

探傷器 FLAW DETECTOR：TOKIMEC SM90D
試験方法 TESTING METHOD：LOCAL IMMERSION METHOD
接触媒質 COUPLANT：WATER
周波数 FREQUENCY：2.25 MHZ
探傷感度 SENSITIVITY：BG : 75%
探傷箇所 SCANNING：AS PER ASTM A435

探触子 PROBE：2.25C281
判定基準 CRITERIA：AS PER ASTM A435
技術者及びレベル EVALUATOR & LEVEL：M. WATANABE, LEVEL II

寸法 DIMENSION (MM)	製鋼番号 CAST No.	製品番号 PLATE No.	検査成績 RESULT	備考 REMARKS
SMPS-EC-R06 38.00 X 1600 X 6000	NP0304	105987-1	ACCEPTABLE	001B

備考欄に＊印がある場合は，別紙・超音波探傷検査結果を参照下さい。

IN CASE THAT AN ASTERISK (*) IS DENOTED IN THE REMARKS COLUMN, PLEASE REFER TO ULTRASONIC EXAMINATION REPORT ENCLOSED HEREIN.

SER. NO.	R0Z1570803
ITEM NO.	CT-9901
PARTNO.	③
TYPE :	SRV-5DF

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed
EETC Q.C Dept. [signature]

検査員 SURVEYOR TO：LG E&C INSPECTION TEAM ☐WITNESSED ☒REVIEWED [signature] Aug 6, '03

上記注文品は超音波探傷検査を実施した結果，御指定の基準に合格したことを証明します。

WE HEREBY CERTIFY THAT THE PLATES DESCRIBED HEREIN HAVE BEEN ALL ACCEPTABLE ON THE ULTRASONIC EXAMINATION IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

M. Tanaka
名古屋製鐵所 厚板商品管理グループ
MANAGER, INSPECTION
NAGOYA WORKS

N16-1(3) Rev. 7

注文者 SHIPPER: ITOCHU MARUBENI
注文者照合番号 REFERENCE No.: 002-1181K08F
契約番号 CONTRACT No.: 2-106-H1-1-Y-1539
商品名 COMMODITY: STEEL PLATE
規格 SPECIFICATION: ASTM A516-01 GRADE 60
文書番号 DOCUMENT No.:

新日本製鐵株式會社 Nippon Steel Corporation
鋼材検査証明書 INSPECTION CERTIFICATE

本社 HEAD OFFICE: 〒100-8071東京都千代田区大手町二丁目6番3号 2-6-3, OTEMACHI, CHIYODA-KU, TOKYO, 100-8071, JAPAN
名古屋製鐵所 NAGOYA WORKS: 〒476-8686愛知県東海市東海町五丁目3番地 5-3, TOKAI-MACHI, TOKAI-CITY, AICHI-PREF., 476-8686, JAPAN

証明書番号 CERTIFICATE No.: M302424 頁 PAGE: 1E
発行年月日 DATE OF ISSUE: 2003-02-17
E2041P06Q2 T....
01 D AE04 ....
24MDMB3.........

需要家 CUSTOMER: ELLIOTT EBARA TURBOMACHINERY CORP.
需要家管理番号 CUSTOMER'S CONTROL No.: R021570803

寸法 DIMENSION MM	員数 QUANTITY	質量 MASS KG	製鋼番号 CAST No. / 試験番号 TEST No.	製品番号 PLATE No.	LOCATION ORIENTATION ※1 ※2	耐力 降伏点 YS YP 0.2% KSI N/MM2	引張強さ TS	伸び EL %	% ※3
SMPS-EC-R06 ④ 459B 01 50X2100X4000	1	3297	NA1037 46272	TESTED-PL 169856-1	BCH	40 276	63 436	40	
SMPS-EC-R06 ⑤ 460B 02 75X1600X3000	1	2826	NA6133 46397	TESTED-PL 024908-1	BCH	37 256	61 424	41	
TOTAL	2	6123							

BEND TEST 曲げ試験 ※4; 衝撃試験 IMPACT TEST: LOCATION ORIENTATION ※1, SUB SIZE ※5, 平均値 AVG, 個々値 EACH (no entries)

化学成分 CHEMICAL COMPOSITION %

	※6	C x100	Si x100	Mn x100	P x1000 / Ti x100	S x1000	Cu x100 / TE1 x100	Ni x100	Cr x100	Mo x100 / TE2 x100	Nb x100	V x100	T.Al / Sol.Al x1000	Ceq1 / Ceq3 / Ceq2 x100	供給状態 CONDITION OF SUPPLY ※7
01		16	20	95	18 / 0	4	1 / 3	2	3	0 / 6	0	0	033	33	
02		16	21	96	14 / 0	4	1 / 2	2	2	0 / 5	0	0	035	33	

HEAT TREATMENT
PLATE NORMALIZING:1670F (910C) X 10MIN.
TEST SPECIMEN SR :1157F (625C) X 360MIN.
VISUAL & DIMENSIONAL INSPECTION : ACCEPTABLE
CAST CEQ1 = C+MN/6+(NI+CU)/15+(CR+MO+V)/5
CAST TE1 = CR + MO
CAST TE2 = CU + NI + CR + MO

50T
EBARA ID.No 459B
75T
EBARA ID.No 460B

INSPECTION TEAM ☐WITNESSED ☒REVIEWED
LG E&C
G. Tsutsumi
Aug 6, '03

SER. NO. R021570803
ITEM NO. CT-9901
PART NO. ④,⑤
TYPE : SRV-5DF

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed
EETC Q.C Dept.

注釈 NOTES ※1 Location Orientation 位置・方向, T: 頭部 Top, B: 底部 Bottom, L: 圧延方向 Longitudinal, C: 直角方向 Transverse, Z: 板厚方向 Through Thickness, R: 45°方向 45Deg. to the Longitudinal Axis
※2 GL 標点距離 Gage Length, A: 50mm平形試験片 Rectangular, B: 50mm丸形試験片 Round, C: 70mm平形試験片 Rectangular, D: 70mm丸形試験片 Round, E: 80mm平形試験片 Rectangular, F: 80mm丸形試験片 Round, G: 200mm, H: 2", I: 8", J: 5.65√So, K: 4√So
※3 RA: 絞り Reduction of Area, YR: 降伏比 Yield Ratio. ※4 A: 合格 Acceptable. ※5 2: 2.5mm, 3: 3.3mm, 4: 3.33mm, 5: 5.0mm, 6: 6.67mm, 7: 7.5mm, 8: 6.7mm, 9: 製品板厚 Plate Thickness. ※6 P: 製品分析 Product Analysis
※7 N: 焼準 Normalized, Q: 焼入れ Quenched, T: 焼戻し Tempered, CR: Controlled Rolled, NIC: NIC Process/TMC Process, CLC: CLC Process/TMC Process, L: Intermediate Heat Treatment, AR: As Rolled
SH: 延性破面率 Shear Fracture, CF: 脆性破面率 Crystallinity Fracture, LE: 横膨出 Lateral Expansion, AGS: オーステナイト粒度 Austenite Grain Size, FGS: フェライト粒度 Ferrite Grain Size, SR: Stress Relieved/Post Weld Heat Treatment
温度 Temperature ☐☐☐C: ☐☐☐°C ☐☐☐F: ☐☐☐°F

上記注文品は御指定の規格または仕様に従って製造され、その要求事項を満足していることを証明します。

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN MADE IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

R021570803
SRV-5DF
略No.453①②
A No.8001-8002
CD74593 CD74594

'03.3.20 今野

M. Tanaka
名古屋製鐵所 厚板管理グループ
MANAGER, INSPECTION
NAGOYA WORKS

N16-1(2) Rev.10

新日本製鐵株式會社
Nippon Steel Corporation
本社：〒100-8071東京都千代田区大手町二丁目６番３号
HEAD OFFICE 2-6-3, OTEMACHI, CHIYODA-KU, TOKYO, 100-8071, JAPAN
名古屋製鐵所：〒476-8686愛知県東海市東海町五丁目３番地
NAGOYA WORKS 5-3,TOKAI-MACHI,TOKAI-CITY,AICHI-PREF.,476-8686,JAPAN

超音波探傷検査証明書
ULTRASONIC EXAMINATION CERTIFICATE

証明書番号 CERTIFICATE No.: PAGE 1E / M302424
発行年月日 DATE OF ISSUE: 2003-02-17

需要家 CUSTOMER: ELLIOTT EBARA TURBOMACHINERY CORP.
注文者 SHIPPER: ITOCHU MARUBENI
契約番号 CONTRACT No.: R021570803 / 2-106-H1-1-Y-1539
規格 SPECIFICATION: ASTM A516-01 GRADE 60
文書番号 DOCUMENT No.:

探傷器 FLAW DETECTOR: TOKIMEC SM90D
試験方法 TESTING METHOD: LOCAL IMMERSION METHOD
接触媒質 COUPLANT: WATER
周波数 FREQUENCY: 2.25 MHZ
探傷感度 SENSITIVITY: BG : 75%
探傷箇所 SCANNING: AS PER ASTM A435

探触子 PROBE: 2.25C28I
判定基準 CRITERIA: AS PER ASTM A435
技術者及びレベル EVALUATOR & LEVEL: O. SUDA, LEVEL II

寸法 DIMENSION (MM)	製鋼番号 CAST No.	製品番号 PLATE No.	検査成績 RESULT	備考 REMARKS
SMPS-EC-R06 50.00 X 2100 X 4000	NA1037	169856-1	ACCEPTABLE	459B ④
SMPS-EC-R06 75.00 X 1600 X 3000	NA6133	024908-1	ACCEPTABLE	460B ⑤

備考欄に＊印がある場合は，別紙・超音波探傷検査結果を参照下さい。

IN CASE THAT AN ASTERISK (*) IS DENOTED IN THE REMARKS COLUMN, PLEASE REFER TO ULTRASONIC EXAMINATION REPORT ENCLOSED HEREIN.

SER. NO.	R021570803
ITEM NO.	CT-9901
PART NO.	④, ⑤
TYPE :	SRV-5DF

ELLIOTT GROUP ☐Witnessed ☑Reviewed
EETC Q.C Dept.

検査員 SURVEYOR TO: INSPECTION TEAM ☐WITNESSED ☒REVIEWED LG E&C J. Tsuitsumi Aug 6, '03

上記注文品は超音波探傷検査を実施した結果，御指定の基準に合格したことを証明します。

WE HEREBY CERTIFY THAT THE PLATES DESCRIBED HEREIN HAVE BEEN ALL ACCEPTABLE ON THE ULTRASONIC EXAMINATION IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

M. Tanaka
名古屋製鐵所 厚板管理グループ
MANAGER, INSPECTION NAGOYA WORKS

N16-1 (3) Rev. 8

注文者 SHIPPER: ITOCHU
注文者照合番号 REFERENCE No.: 002-1181H05B
契約番号 CONTRACT No.: 1-106-H1-1-9-1541
商品名 COMMODITY: STEEL PLATE
規格 SPECIFICATION: ASTM A516-90 GRADE 60
文書番号 DOCUMENT No.:
需要家 CUSTOMER: EBARA CORP.

新日本製鐵株式會社
Nippon Steel Corporation
鋼材検査証明書
INSPECTION CERTIFICATE

本社 HEAD OFFICE: 〒100-8071東京都千代田区大手町二丁目6番3号 2-6-3, OTEMACHI, CHIYODA-KU, TOKYO, 100-8071, JAPAN
名古屋製鐵所 NAGOYA WORKS: 〒476-8686愛知県東海市東海町五丁目3番地 5-3, TOKAI-MACHI, TOKAI-CITY, AICHI-PREF., 476-8686, JAPAN

証明書番号 CERTIFICATE No.: M118168 頁 PAGE: 1E
発行年月日 DATE OF ISSUE: 2001-11-21
需要家管理番号 CUSTOMER'S CONTROL No.: R001500104
E2041P06Q1 T....
01 D AE04 ....
24MDMB3.....

寸法 DIMENSION MM	員数 QUANTITY	質量 MASS KG	製鋼番号 CAST No. / 試験番号 TEST No.	製品番号 PLATE No.	LOCATION ORIENTATION ※1	GL ※2	引張試験 TENSILE TEST 耐力 降伏点 YS 0.2% KSI N/MM2	引張強さ TS	伸び EL %	% ※3	BEND TEST ※4	LOCATION ※1	SIZE ※5	衝撃試験 IMPACT TEST 平均値 AVG	個々値 EACH	化学成分 CHEMICAL COMPOSITION % C X100	Si X100	Mn X100	P X1000	S X1000	Cu X100	Ni X100	Cr X100	Mo X100	Nb X100	V X100	T. Al X1000	Ceq.1 X100	Ceq.3 X100	Sol. Al X1000	Ceq.2 X100	供給状態 CONDITION OF SUPPLY ※7
SMPS-EC-R06	05		NJ5248	TESTED-PL			38.7	63.1								16	21	95	13	4	1	2	3	1	0	0	35				
100X1000X3000	1	2355	91828	428632-1	BCH		267	435	40										4		7										

HEAT TREATMENT
PLATE NORMALIZING: 1670F (910C) X 10MIN.
TEST SPECIMEN SR : 1157F (625C) X 360MIN.
VISUAL & DIMENSIONAL INSPECTION : ACCEPTABLE
CAST TE1 = CR + MO
CAST TE2 = CU + NI + CR + MO

SER. NO.	R021570803
ITEM NO.	CT-9901
PARTNO.	⑥
TYPE	SRV-5DF

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed
EETC Q.C Dept.

INSPECTION TEAM
☐WITNESSED ☒REVIEWED
HG E&C Aug 6, '03

TOTAL	1	2355

注釈 NOTES ※1 Location Orientation 位置・方向, T: 頭部 Top, B: 底部 Bottom, L: 圧延方向 Longitudinal, C: 直角方向 Transverse, Z: 板厚方向 Through Thickness, R: 45°方向 45 Deg. to the Longitudinal Axis
※2 GL 標点距離 Gage Length, A: 50mm平形試験片 Rectangular, B: 50mm丸形試験片 Round, C: 70mm 平形試験片 Rectangular, D: 70mm 丸形試験片 Round, E: 80mm 平形試験片 Rectangular, F: 80mm 丸形試験片 Round, G: 200mm, H: 2", I: 8", J: 5.65√So, K: 4√So
※3 RA: 絞り Reduction of Area, YR: 降伏比 Yield Ratio, ※4 A: 合格 Acceptable, ※5 2: 2.5mm, 3: 3.3mm, 4: 3.33mm, 5: 5.0mm, 6: 6.67mm, 7: 7.5mm, 8: 6.7mm, 9: 製品板厚 Plate Thickness, ※6 P: 製品分析 Product Analysis
※7 N: 焼準 Normalized, Q: 焼入れ Quenched, T: 焼戻し Tempered, CR: Controlled Rolled, NIC: NIC Process/TMC Process, CLC: CLC Process/TMC Process, L: Intermediate Heat Treatment, AR: As Rolled
SH: 延性破面率 Shear Fracture, CF: 脆性破面率 Crystallinity Fracture, LE: 横膨出 Lateral Expansion, AGS: オーステナイト粒度 Austenite Grain Size, FGS: フェライト粒度 Ferrite Grain Size, SR: Stress Relieved/Post Weld Heat Treatment
温度 Temperature ☐☐☐C: ☐☐☐°C ☐☐☐F: ☐☐☐°F

上記注文品は御指定の規格または仕様に従って製造され、その要求事項を満足していることを証明します。

EBARA I.D.№
096A

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN MADE IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

01. 12. 11 封緘

M. Tanaka
名古屋製鐵所 厚板商品管理グループ
MANAGER, INSPECTION
NAGOYA WORKS

N16-1(2) Rev. 9

16

新日本製鐵株式會社
Nippon Steel Corporation

社：〒100-8071東京都千代田区大手町二丁目６番３号
HEAD OFFICE 2-6-3, OTEMACHI, CHIYODA-KU, TOKYO, 100-8071, JAPAN
名古屋製鐵所：〒476-8686愛知県東海市東海町五丁目３番地
NAGOYA WORKS 5-3,TOKAI-MACHI,TOKAI-CITY,AICHI-PREF.,476-8686,JAPAN

超音波探傷検査証明書
ULTRASONIC EXAMINATION CERTIFICATE

証明書番号 CERTIFICATE No.: M118168
発行年月日 DATE OF ISSUE: 2001-11-21

需要家 CUSTOMER: EBARA CORP.
注文者 SHIPPER: ITOCHU
契約番号 CONTRACT No.: R001500104
1-106-H1-1-9-1541
規格 SPECIFICATION: ASTM A516-90 GRADE 60
文書番号 DOCUMENT No.:

探傷器 FLAW DETECTOR: TOKIMEC SM90D
試験方法 TESTING METHOD: LOCAL IMMERSION METHOD
接触媒質 COUPLANT: WATER
周波数 FREQUENCY: 2.25 MHZ
探傷感度 SENSITIVITY: BG : 75%
探傷箇所 SCANNING: AS PER ASTM A435

探触子 PROBE: 2.25C28I
判定基準 CRITERIA: AS PER ASTM A435
技術者及びレベル EVALUATOR & LEVEL: O. SUDA, LEVEL II

寸法 DIMENSION (MM)	製鋼番号 CAST No.	製品番号 PLATE No.	検査成績 RESULT		備考 REMARKS
SMPS-EC-R06 100.00 X 1000 X 3000	NJ5248	428632-1	ACCEPTABLE		備考欄に＊印がある場合は，別紙・超音波探傷検査結果を参照下さい。 IN CASE THAT AN ASTERISK (*) IS DENOTED IN THE REMARKS COLUMN, PLEASE REFER TO ULTRASONIC EXAMINATION REPORT ENCLOSED HEREIN.
					EBARA I.D.No 096A

SER. NO. RDZ1570803
ITEM NO. CT-9901
PARTNO. ⑥
TYPE : SRV-5DF

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed
EETC Q.C Dept.

'01. 12. 11 野崎

検査員：SURVEYOR TO
INSPECTION TEAM
☐WITNESSED ☒REVIEWED
LG E&C
Aug 6. '07

上記注文品は超音波探傷検査を実施した結果，御指定の基準に合格したことを証明します。

WE HEREBY CERTIFY THAT THE PLATES DESCRIBED HEREIN HAVE BEEN ALL ACCEPTABLE ON THE ULTRASONIC EXAMINATION IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

M. Tanaka
名古屋製鐵所 厚板商品管理グループリーダー
MANAGER, INSPECTION
NAGOYA WORKS

注文者 SHIPPER: ITOCHU MARUBENI
注文者照合番号 REFERENCE No.: 002-1181K08F
契約番号 CONTRACT No.: 2-106-H1-1-Y-1539
商品名 COMMODITY: STEEL PLATE
規格 SPECIFICATION: ASTM A516-01 GRADE 60
文書番号 DOCUMENT No.:

新日本製鐵株式會社
Nippon Steel Corporation
鋼材検査証明書
INSPECTION CERTIFICATE

本社 HEAD OFFICE: 〒100-8071 東京都千代田区大手町二丁目6番3号 2-6-3, OTEMACHI, CHIYODA-KU, TOKYO, 100-8071, JAPAN
名古屋製鐵所 NAGOYA WORKS: 〒476-8686 愛知県東海市東海町五丁目3番地 5-3, TOKAI-MACHI, TOKAI-CITY, AICHI-PREF., 476-8686, JAPAN

証明書番号 CERTIFICATE No.: M302750 PAGE: 1E
発行年月日 DATE OF ISSUE: 2003-02-24
E2041P06Q2 T....
01 D AE04 ....
24MDMB3.....

需要家 CUSTOMER: ELLIOTT EBARA TURBOMACHINERY CORP.
需要家管理番号 CUSTOMER'S CONTROL No.: R021570803

寸法 DIMENSION MM	員数 QUANTITY	質量 MASS KG	製鋼番号 CAST No. / 試験番号 TEST No.	製品番号 PLATE No.	LOCATION ORIENTATION ※1	GL ※2	引張試験 TENSILE TEST 耐力 降伏点 YS YP 0.2% KSI N/MM2	引張強さ TS	伸び EL %	% ※3	※4 BEND TEST 曲げ試験	LOCATION ORIENTATION ※1	※5 SUB SIZE	衝撃試験 IMPACT TEST 平均値 AVG	個々値 EACH	※6	C X100 X1000	Si X100	Mn X100	P X1000 TI	S X1000	Cu X100 TE1	Ni X100	Cr X100	Mo X100 TE2	Nb X100 X1000	V X100 X1000	T. Al X100 X1000 Ceq.3	Sol. Al X1000	Ceq. 1 X100 Ceq. 2 X100	供給状態 CONDITION OF SUPPLY ※7
SMPS-EC-R06 03			VZ7597	TESTED-PL			38	61									16	20	95	12	6	2	2	2	0	0	0	42	32	
130X1000X3000	1	3060	44606	167151-1	BCH		259	423	40											0		2			6					
				HEAT TREATMENT																										
				PLATE NORMALIZING: 1670F (910C) X 10MIN.																										
				TEST SPECIMEN SR : 1157F (625C) X 360MIN.																										
				VISUAL & DIMENSIONAL INSPECTION : ACCEPTABLE																										
				CAST CEQ1 = C+MN/6+ (NI+CU) /15+ (CR+MO+V) /5																										
				CAST TE1 = CR + MO																										
				CAST TE2 = CU + NI + CR + MO																										
TOTAL	1	3060																												

SER. NO. R021570803
ITEM NO. CT-9901
PARTNO. ⑦
TYPE : SRV-5DF

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed
EETC Q.C Dept.

INSPECTION TEAM
☐WITNESSED ☒REVIEWED
LG E&C J. Tsutsumi Aug 6, '03

注釈 NOTES
※1 Location Orientation 位置・方向, T: 頭部 Top, B: 底部 Bottom, L: 圧延方向 Longitudinal, C: 直角方向 Transverse, Z: 板厚方向 Through Thickness, R: 45°方向 45Deg. to the Longitudinal Axis
※2 GL 標点距離 Gage Length, A: 50mm平形試験片 Rectangular, B: 50mm丸形試験片 Round, C: 70mm 平形試験片 Rectangular, D: 70mm 丸形試験片 Round, E: 80mm平形試験片 Rectangular, F: 80mm丸形試験片 Round, G: 200mm, H: 2", I: 8", J: 5.65√So, K: 4√So
※3 RA: 絞り Reduction of Area, YR: 降伏比 Yield Ratio, ※4 A: 合格 Acceptable, ※5 2: 2.5mm, 3: 3.3mm, 4: 3.33mm, 5: 5.0mm, 6: 6.67mm, 7: 7.5mm, 8: 8.7mm, 9: 製品板厚 Plate Thickness, ※6 P: 製品分析 Product Analysis
※7 N: 焼準 Normalized, Q: 焼入れ Quenched, T: 焼戻し Tempered, CR: Controlled Rolled, NIC: NIC Process/TMC Process, CLC: CLC Process/TMC Process, L: Intermediate Heat Treatment, AR: As Rolled
SH: 延性破面率 Shear Fracture, CF: 脆性破面率 Crystallinity Fracture, LE: 横膨出 Lateral Expansion, AGS: オーステナイト粒度 Austenite Grain Size, FGS: フェライト粒度 Ferrite Grain Size, SR: Stress Relieved/Post Weld Heat Treatment
温度 Temperature □□□C: □□□°C □□□F: □□□°F

R021570803

上記注文品は御指定の規格または仕様に従って製造され、その要求事項を満足していることを証明します。

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN MADE IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

検収品 03.3.20 今野

M. Tanaka
名古屋製鐵所 厚板管理グループ
MANAGER, INSPECTION
NAGOYA WORKS

EBARA ID.No 461B

M16-1 (2) Rev. 10

新日本製鐵株式會社
Nippon Steel Corporation
本　社：〒100-8071東京都千代田区大手町二丁目６番３号
HEAD OFFICE：2-6-3, OTEMACHI, CHIYODA-KU, TOKYO, 100-8071, JAPAN
名古屋製鐵所：〒476-8686愛知県東海市東海町五丁目３番地
NAGOYA WORKS：5-3,TOKAI-MACHI,TOKAI-CITY,AICHI-PREF.,476-8686,JAPAN

超音波探傷検査証明書
ULTRASONIC EXAMINATION CERTIFICATE

証明書番号 / CERTIFICATE No.：PAGE 1E　M302750
発行年月日 / DATE OF ISSUE：2003-02-24

需要家 / CUSTOMER：ELLIOTT EBARA TURBOMACHINERY CORP.
注文者 / SHIPPER：ITOCHU MARUBENI
契約番号 / CONTRACT No.：R021570803　2-106-H1-1-Y-1539
規格 / SPECIFICATION：ASTM A516-01 GRADE 60
文書番号 / DOCUMENT No.：

探傷器 / FLAW DETECTOR：TOKIMEC SM90D
試験方法 / TESTING METHOD：LOCAL IMMERSION METHOD
接触媒質 / COUPLANT：WATER
周波数 / FREQUENCY：2.25 MHZ
探傷感度 / SENSITIVITY：BG : 75%
探傷箇所 / SCANNING：AS PER ASTM A435

探触子 / PROBE：2.25C28I
判定基準 / CRITERIA：AS PER ASTM A435
技術者及びレベル / EVALUATOR & LEVEL：T. SHINOMACHI, LEVEL II

寸法 DIMENSION (MM)	製鋼番号 CAST No.	製品番号 PLATE No.	検査成績 RESULT	備考 REMARKS
SMPS-EC-R06 130.00 X 1000 X 3000	VZ7597	167151-1	ACCEPTABLE	461B

備考欄に＊印がある場合は，別紙・超音波探傷検査結果を参照下さい。

IN CASE THAT AN ASTERISK (*) IS DENOTED IN THE REMARKS COLUMN, PLEASE REFER TO ULTRASONIC EXAMINATION REPORT ENCLOSED HEREIN.

SER. NO.	R021570803
ITEM NO.	CT-9901
PARTNO.	①
TYPE :	SRV-5DF

ELLIOTT EBARA GROUP　☐Witnessed ☑Reviewed
EETC Q.C Dept.

検査員 / SURVEYOR TO：INSPECTION TEAM ☐WITNESSED ☒REVIEWED LG E&C Aug. 6, '03

上記注文品は超音波探傷検査を実施した結果，御指定の基準に合格したことを証明します。

WE HEREBY CERTIFY THAT THE PLATES DESCRIBED HEREIN HAVE BEEN ALL ACCEPTABLE ON THE ULTRASONIC EXAMINATION IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

M. Tanaka
名古屋製鐵所 厚板管理グループリーダー
MANAGER, INSPECTION NAGOYA WORKS

N16-1(3) Rev. 8

注文者 SHIPPER: ITOCHU MARUBENI
注文者照合番号 REFERENCE No.: 002-1181C123
契約番号 CONTRACT No.: 2-106-H4-1-4-1544
商品名 COMMODITY: STEEL PLATE
規格 SPECIFICATION: ASTM A516-90 GRADE 60
文書番号 DOCUMENT No.:
需要家 CUSTOMER: EBARA CORP.

新日本製鐵株式會社
Nippon Steel Corporation
鋼材検査証明書
INSPECTION CERTIFICATE

本社 HEAD OFFICE: 〒100-8071 東京都千代田区大手町二丁目6番3号 2-6-3, OTEMACHI, CHIYODA-KU, TOKYO, 100-8071, JAPAN
名古屋製鐵所 NAGOYA WORKS: 〒476-8686 愛知県東海市東海町五丁目3番地 5-3, TOKAI-MACHI, TOKAI-CITY, AICHI-PREF., 476-8686, JAPAN

証明書番号 CERTIFICATE No.: M206881
頁 PAGE: 1E
発行年月日 DATE OF ISSUE: 2002-05-30
需要家管理番号 CUSTOMER'S CONTROL No.: R010945403
E2041543Q1 T....
01 D BE04 ....
24MDMB3.....

寸法 DIMENSION MM	員数 QUANTITY	質量 MASS KG	製鋼番号 CAST No. / 試験番号 TEST No.	製品番号 PLATE No.	LOCATION ORIENTATION ※1 ※2	引張試験 TENSILE TEST 耐力 降伏点 YS 0.2% KSI N/MM2	引張強さ TS	伸び EL %	% ※3	BEND TEST 合否 ※4	LOCATION ORIENTATION ※1	SIZE ※5	衝撃試験 IMPACT TEST 平均値 AVG	個々値 EACH	化学成分 CHEMICAL COMPOSITION % C ※6 X1000	Si X1000	Mn X1000	P X1000	S X1000	Cu X100	Ni X100	Cr X100	Mo X100	Nb X100	V X100	T.Al X1000	Ceq.1 X100	Ceq.3 X100	Sol.Al X1000	Ceq.2 X100	供給状態 CONDITION OF SUPPLY ※7
SMPS-EC-R07	01		VQ6670	TESTED-PL		40	65								16	23	110	11	2	1	2	3	0	0	0	27	35			
178X1250X5050	1	8818	13689	021732-1	BCH	279	447	40										3		6										

HEAT TREATMENT
PLATE NORMALIZING: 910CX 10MIN. (1670F)
TEST SPECIMEN SR: 1157F(625C) X 360MIN.
VISUAL & DIMENSIONAL INSPECTION : ACCEPTABLE
CAST CEQ1 = C+MN/6+ (NI+CU) /15+ (CR+MO+V) /5
CAST TE1 = CR + MO
CAST TE2 = CU + NI + CR + MO

EBARA I.D.No 073B

SER. NO.	R02L570803
ITEM NO.	CT-9901
PARTNO.	⑧
TYPE :	SRV-5DF

ELLIOTT EBARA GROUP
☐Witnessed
☑Reviewed
EETC Q.C Dept.

TOTAL	1	8818	

注釈 NOTES
※1 Location Orientation 位置・方向, T: 頭部 Top, B: 底部 Bottom, L: 圧延方向 Longitudinal, C: 直角方向 Transverse, Z: 板厚方向 Through Thickness, R: 45°方向 45Deg. to the Longitudinal Axis
※2 GL 標点距離 Gage Length, A: 50mm平形試験片 Rectangular, B: 50mm丸形試験片 Round, C: 70mm平形試験片 Rectangular, D: 70mm丸形試験片 Round, E: 80mm平形試験片 Rectangular, F: 80mm丸形試験片 Round, G: 200mm, H: 2", I: 8", J: 5.65√So, K: 4√So
※3 RA: 絞り Reduction of Area, YR: 降伏比 Yield Ratio. ※4 A: 合格 Acceptable. ※5 2: 2.5mm, 3: 3.3mm, 4: 3.33mm, 5: 5.0mm, 6: 6.67mm, 7: 7.5mm, 8: 6.7mm, 9: 製品板厚 Plate Thickness. ※6 P: 製品分析 Product Analysis
※7 N: 焼準 Normalized, Q: 焼入れ Quenched, T: 焼戻し Tempered, CR: Controlled Rolled, NIC: NIC Process/TMC Process, CLC: CLC Process/TMC Process, L: Intermediate Heat Treatment, AR: As Rolled
SH: 延性破面率 Shear Fracture, CF: 脆性破面率 Crystallinity Fracture, LE: 横膨出 Lateral Expansion, AGS: オーステナイト粒度 Austenite Grain Size, FGS: フェライト粒度 Ferrite Grain Size, SR: Stress Relieved/Post Weld Heat Treatment
温度 Temperature ☐☐☐C: ☐☐☐°C ☐☐☐F: ☐☐☐°F

上記注文品は御指定の規格または仕様に従って製造され、その要求事項を満足していることを証明します。

INSPECTION TEAM
☐WITNESSED ☒REVIEWED
LG E&C
Y. Tsutsumi
6 Aug. '02

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN MADE IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

'02.6.12 野崎

M. Tanaka
名古屋製鐵所 厚板管理グループ
MANAGER, INSPECTION
NAGOYA WORKS

N16-1(2) Rev. 10

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新日本製鐵株式會社
Nippon Steel Corporation

超音波探傷検査証明書
ULTRASONIC EXAMINATION CERTIFICATE

社：〒100-8071東京都千代田区大手町二丁目６番３号
HEAD OFFICE 2-6-3, OTEMACHI, CHIYODA-KU, TOKYO, 100-8071, JAPAN
名古屋製鐵所：〒476-8686愛知県東海市東海町五丁目３番地
NAGOYA WORKS 5-3,TOKAI-MACHI, TOKAI-CITY, AICHI-PREF., 476-8686, JAPAN

証明書番号 CERTIFICATE No.: PAGE 1E M206881
発行年月日 DATE OF ISSUE: 2002-05-30

需要家 CUSTOMER: EBARA CORP.
注文者 SHIPPER: ITOCHU MARUBENI
契約番号 CONTRACT No.: R010945403 2-106-H4-1-4-1544
規格 SPECIFICATION: ASTM A516-90 GRADE 60
文書番号 DOCUMENT No.:

探傷器 FLAW DETECTOR: TOKIMEC SM90D
試験方法 TESTING METHOD: LOCAL IMMERSION METHOD
接触媒質 COUPLANT: WATER
周波数 FREQUENCY: 2.25 MHZ
探傷感度 SENSITIVITY: BG : 75%
探傷箇所 SCANNING: AS PER ASTM A435

探触子 PROBE: 2.25C28I
判定基準 CRITERIA: AS PER ASTM A435
技術者及びレベル EVALUATOR & LEVEL: O. SUDA, LEVEL II

寸法 DIMENSION (MM)	製鋼番号 CAST No.	製品番号 PLATE No.	検査成績 RESULT		備考 REMARKS
SMPS-EC-R07 178.00 X 1250 X 5050	VQ6670	021732-1	ACCEPTABLE	073B	

備考欄に＊印がある場合は，別紙・超音波探傷検査結果を参照下さい。

IN CASE THAT AN ASTERISK (*) IS DENOTED IN THE REMARKS COLUMN, PLEASE REFER TO ULTRASONIC EXAMINATION REPORT ENCLOSED HEREIN.

SER. NO.	ROZ1570803
ITEM NO.	CT-9901
PARTNO.	⑧
TYPE :	SRV-5DF

ELLIOTT EBARA GROUP '02.6.12 EETC Q.C Dept.
☐Witnessed ☑Reviewed

検査員 SURVEYOR TO: INSPECTION TEAM ☐WITNESSED ☒REVIEWED LG E&C Aug. 6. '03

上記注文品は超音波探傷検査を実施した結果，御指定の基準に合格したことを証明します。

WE HEREBY CERTIFY THAT THE PLATES DESCRIBED HEREIN HAVE BEEN ALL ACCEPTABLE ON THE ULTRASONIC EXAMINATION IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

M. Tanaka
名古屋製鐵所 厚板管理グループ
MANAGER, INSPECTION
NAGOYA WORKS

N16-1 (3) Rev. 8

注文者 SHIPPER: ITOCHU MARUBENI
注文者照合番号 REFERENCE No.: 002-1181C121
契約番号 CONTRACT No.: 2-106-H4-1-4-1541
商品名 COMMODITY: STEEL PLATE
規格 SPECIFICATION: ASTM A516-01 GRADE 60
文書番号 DOCUMENT No.:
需要家 CUSTOMER: EBARA CORP.

新日本製鐵株式會社
Nippon Steel Corporation
鋼材検査証明書
INSPECTION CERTIFICATE

本社 HEAD OFFICE: 〒100-8071 東京都千代田区大手町二丁目6番3号 2-6-3, OTEMACHI, CHIYODA-KU, TOKYO, 100-8071, JAPAN
名古屋製鐵所 NAGOYA WORKS: 〒476-8686 愛知県東海市東海町五丁目3番地 5-3, TOKAI-MACHI, TOKAI-CITY, AICHI-PREF., 476-8686, JAPAN

証明書番号 CERTIFICATE No.: M207946 頁 PAGE: 1E
発行年月日 DATE OF ISSUE: 2002-06-17
E2041543Q1 FT...
01 D BE04 ....
需要家管理番号 CUSTOMER'S CONTROL No.: R010945402
24MDMC3.....

寸法 DIMENSION MM	員数 QUANTITY	質量 MASS KG	製鋼番号 CAST No. / 試験番号 TEST No.	製品番号 PLATE No.	引張試験 TENSILE TEST: LOCATION ORIENTATION ※1	※2	耐力 降伏点 YS 0.2% KSI N/MM2	引張強さ TS	伸び EL %	R A % ※3	※4 BEND TEST 曲げ試験	衝撃試験 IMPACT TEST: LOCATION ※1	ORIENTATION	※5 SUB SIZE	平均値 AVG	個々値 EACH	化学成分 CHEMICAL COMPOSITION %: ※6	C X100	Si X100	Mn X100	P X1000	S X1000	Cu X100	Ni X100	Cr X100	Mo X100	Nb X100	V X100	T. Al X100	Ceq.1 X100	供給状態 CONDITION OF SUPPLY ※7
SMPS-EC-R07 01			NS9598	TESTED-PL			39	66																						
229X1350X6500	1	15777	18267	022149-1	BCH		272	454	39									16	25	113	13	3	1	2	4	0	0	0	36	36	
																					0		4			7				
EBARA ID.No 058B					BZ					74																				
					TZ					73																				
~~SMPS-EC-R07 01~~			~~NS9949~~	~~TESTED-PL~~			~~39~~	~~67~~										~~17~~	~~25~~	~~108~~	~~11~~	~~2~~	~~2~~	~~2~~	~~4~~	~~0~~	~~0~~	~~0~~	~~42~~	~~36~~	
~~229X1350X6500~~	~~1~~	~~15777~~	~~18268~~	~~022150-1~~	~~BCH~~		~~271~~	~~460~~	~~37~~												~~9~~		~~4~~			~~8~~				
~~EBARA I.D.No 059B~~					~~BZ~~					~~70~~																				
					~~TZ~~					~~69~~																				

SER. NO.	R021570803
ITEM NO.	CT-9901
PARTNO.	⑨
TYPE	SRV-5DF

HEAT TREATMENT
PLATE NORMALIZING: 910CX 10MIN. (1670F)
TEST SPECIMEN SR :1157F (625C) X 360MIN.
VISUAL & DIMENSIONAL INSPECTION : ACCEPTABLE
CAST CEQ1 = C+MN/6+(NI+CU)/15+(CR+MO+V)/5
CAST TE1 = CR + MO
CAST TE2 = CU + NI + CR + MO
THIS PLATE IS MET THE LIMITATION OF ASTM A20 5.3.
LOW HYDROGEN PRACTICE ARE USED VACUUM DEGASSING.
SPECIAL PRACTICE ARE USED HEAVY PASS REDUCTIONS.

TOTAL 2 31554

注釈 NOTES ※1 Location Orientation 位置・方向, T: 頭部 Top, B: 底部 Bottom, L: 圧延方向 Longitudinal, C: 直角方向 Transverse, Z: 板厚方向 Through Thickness, R: 45°方向 45 Deg. to the Longitudinal Axis
※2 GL 標点距離 Gage Length, A: 50mm平形試験片 Rectangular, B: 50mm丸形試験片 Round, C: 70mm平形試験片 Rectangular, D: 70mm丸形試験片 Round, E: 80mm平形試験片 Rectangular, F: 80mm丸形試験片 Round, G: 200mm, H: 2", I: 8", J: 5.65√So, K: 4√So
※3 RA: 絞り Reduction of Area, YR: 降伏比 Yield Ratio, ※4 A: 合格 Acceptable, ※5 2: 2.5mm, 3: 3.3mm, 4: 3.33mm, 5: 5.0mm, 6: 6.67mm, 7: 7.5mm, 8: 6.7mm, 9: 製品板厚 Plate Thickness, ※6 P: 製品分析 Product Analysis
※7 N: 焼準 Normalized, Q: 焼入れ Quenched, T: 焼戻し Tempered, CR: Controlled Rolled, NIC: NIC Process/TMC Process, CLC: CLC Process/TMC Process, L: Intermediate Heat Treatment, AR: As Rolled
SH: 延性破面率 Shear Fracture, CF: 脆性破面率 Crystallinity Fracture, LE: 横膨出 Lateral Expansion, AGS: オーステナイト粒度 Austenite Grain Size, FGS: フェライト粒度 Ferrite Grain Size, SR: Stress Relieved/Post Weld Heat Treatment
温度 Temperature □□□C: □□□°C □□□F: □□□°F

上記注文品は御指定の規格または仕様に従って製造され、その要求事項を満足していることを証明します。

INSPECTION TEAM
☐WITNESSED ☒REVIEWED
LG E&C Y. Tsutsumi Aug 6, '03

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN MADE IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed
EETC Q.C Dept. T. Tabe

M. Tanaka
名古屋製鐵所 厚板管理グループリーダー
MANAGER, INSPECTION
NAGOYA WORKS

N16-1(2) Rev.10

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新日本製鐵株式會社
Nippon Steel Corporation

社 : 〒100-8071 東京都千代田区大手町二丁目６番３号
HEAD OFFICE : 2-6-3, OTEMACHI, CHIYODA-KU, TOKYO, 100-8071, JAPAN
名古屋製鐵所 : 〒476-8686 愛知県東海市東海町五丁目３番地
NAGOYA WORKS : 5-3, TOKAI-MACHI, TOKAI-CITY, AICHI-PREF., 476-8686, JAPAN

超音波探傷検査証明書
ULTRASONIC EXAMINATION CERTIFICATE

証明書番号 / CERTIFICATE No. : PAGE 1E / M207946
発行年月日 / DATE OF ISSUE : 2002-06-17

需要家 / CUSTOMER : EBARA CORP.
注文者 / SHIPPER : ITOCHU MARUBENI
契約番号 / CONTRACT No. : R010945402 / 2-106-H4-1-4-1541
規格 / SPECIFICATION : ASTM A516-01 GRADE 60
文書番号 / DOCUMENT No. :

探傷器 / FLAW DETECTOR : TOKIMEC SM90D
試験方法 / TESTING METHOD : LOCAL IMMERSION METHOD
接触媒質 / COUPLANT : WATER
周波数 / FREQUENCY : 2.25 MHZ
探傷感度 / SENSITIVITY : BG : 75%
探傷箇所 / SCANNING : AS PER ASTM A435

探触子 / PROBE : 2.25C28I
判定基準 / CRITERIA : AS PER ASTM A435
技術者及びレベル / EVALUATOR & LEVEL : Y. OGATA, LEVEL II

寸法 DIMENSION (MM)	製鋼番号 CAST No.	製品番号 PLATE No.	検査成績 RESULT	備考 REMARKS
SMPS-EC-R07 229.00 X 1350 X 6500	NS9598	022149-1	ACCEPTABLE	058B
~~SMPS-EC-R07 229.00 X 1350 X 6500~~	~~VS3949~~	~~022150-1~~	~~ACCEPTABLE~~	~~059B~~

備考欄に＊印がある場合は，別紙・超音波探傷検査結果を参照下さい。

IN CASE THAT AN ASTERISK (*) IS DENOTED IN THE REMARKS COLUMN, PLEASE REFER TO ULTRASONIC EXAMINATION REPORT ENCLOSED HEREIN.

SER. NO.	ROZ1570803
ITEM NO.	CT-9901
PARTNO.	⑨
TYPE :	SRV-5DF

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed
EETC Q.C Dept.

検査員 / SURVEYOR TO : INSPECTION TEAM ☐WITNESSED ☒REVIEWED LG E&C Aug. 6, '03

上記注文品は超音波探傷検査を実施した結果，御指定の基準に合格したことを証明します。

WE HEREBY CERTIFY THAT THE PLATES DESCRIBED HEREIN HAVE BEEN ALL ACCEPTABLE ON THE ULTRASONIC EXAMINATION IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

M. Tanaka
名古屋製鐵所 厚板管理グループ
MANAGER, INSPECTION
NAGOYA WORKS

N16-1 (3) Rev. 8

MATERIAL TEST REPORT
材料試験成績表

Date 4 MAR. '03 Report No. 030250

Manufacturer's
Order No. M02-12-040
Purchaser
御注文主 ELLIOTT EBARA TURBOMACHINERY CORPORATION
Name of Article
品 名 SHAFT (For B-ROTOR)
Material
材 質 ASTM A470 CL.4
Specification No.(仕様書No.) SMPS-ES-F15 REV.6 〔EBARA STD.〕
Witness
立会者
Purchaser's Order No.
注文主番号 CD79967
Plant/Project
Drawing No.
図 番 ES/8601600 REV.0
TYPE No. JSRV-5DF
WORK No. R021570803

S. Seo
Chief of Quality Control Section

Testing Machine No. : T-70 NG28,I-76 NG7,920,H-93 NG2

F.R. 1/2.0U 9.1S
Mass 1077 kg

Piece No. 製品番号	Size of Test Specimen Diameter Gauge Length 0.5" × 2"	Yield Strength $\sigma_{0.02}$ K.S.I (N/mm²)	Tensile Strength K.S.I (N/mm²)	Elongation %	Reduction of Area %		Impact Test Notch 2mmV Charpy Test temp. 20 ℃ ft-lb (J)	Hardness Brinell
	Test piece No. 試験片番号 Min. Max.	85 (587)	105 (725)	17	45	Test piece No. 試験片番号	Average Min.	Min. Max. 255
11181-204	11181-204L	93.1 (642)	110.5 (762)	25	65			229
	Test piece No. 試験片番号 Min. Max.	85 (587)	105 (725)	16	40	Test piece No. 試験片番号	Average Min. 20 (27)	Min. Max. 255
	11181-204T1	94.6 (652)	110.5 (762)	24	60	V-1	37.4 (50.7)	229
	11181-204T2	96.0 (662)	111.1 (766)	24	61	V-3	35.5 (48.2)	229

QUANTITY 1

Heat Treatment
N1. 900 ℃ × 16 h A.C.
T1. 650 ℃ × 16 h A.C.
N2. 850 ℃ × 8 h B.A.C.
T2. 655 ℃ × 12.5 h A.C.
S.R. 615 ℃ × 14 h F.C.

INSPECTION TEAM
☐WITNESSED ☒REVIEWED
LG E&C J. Tsutsumi Aug. 26 '03

* VACUUM CARBON DEOXIDIZED TREATMENT HAS BEEN MADE

Chemical Composition 化学成分 %

Heat No. 溶解番号	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Sb
Min.			0.20				2.50		0.25	0.03	
Max.	0.28	0.10	0.60	0.012	0.015			0.75			
11181 Ladle	0.22	0.10	0.42	0.004	0.006		2.66	0.53	0.50	0.11	0.001
Product	0.23	0.09	0.42	0.004	0.006		2.67	0.52	0.50	0.11	0.001

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed
EETC Q.C Dept.

R021570803
SRV-5DF
Item No.; CT-9901
B-Rotor
Part Name; Shaft

Heat treatment
N. Normalizing
Q. Quenching
S.T. Solution Treatment
A. Annealing
T. Tempering
S.R. Stress Relieving
A.C. Air Cooling
O.C. Oil Cooling
F.C. Furnace Cooling
W.C. Water Cooling
P.H. Precipitation Hardening
B.C. Blast Cooling
W.S.P.C. Water Spray Cooling
B.A.C. Blast Air Cooling

Other
L. Longitudinal
Ta. Tangential
R. Radius
T.S. Top Side
M. Middle
B.S Bottom Side
$\sigma_{0.2}$ 0.2% offset
$\sigma_{0.02}$ 0.02% offset
F.R. Forging Ratio
H.T. Heat Treatment

PACIFIC STEEL MFG. CO., LTD. TOYAMA WORKS
大平洋製鋼株式会社 富山製造所

ULTRASONIC INSPECTION REPORT
超音波探傷試験成績表

Date 16 FEB. '03 Report No. 030250

Manufacturer's Order No. M02-12-040

Purchaser 御注文主 ELLIOTT EBARA TURBOMACHINERY CORPORATION

Name of Article 品名 SHAFT (For B-ROTOR)

Material 材質 ASTM A470 CL.4

Purchaser's Order No. 注文主番号 CD79967

Specification No.(仕様書No.) SMPS-ES-F15 REV.6 [EBARA STD.] Witness

Drawing No. 図番 ES/8601600 REV.0

Plant/Project

TYPE No. JSRV-5DF

WORK No. R021570803

Examined	Reviewed	Approved
J. Sakai	—	K. Shimada
SNT-TC-1A LEVEL II	SNT-TC-1A LEVEL III	SNT-TC-1A LEVEL III

Piece No. 製品番号: 11181-204

QUANTITY 1

Conditions of Ultrasonic Inspection 探傷条件

Defect Detector 探傷器: Kraut Krämer USM 3S

Couplant 接触媒質: Machine oil マシン油

Procedure No. 要領書No.: MIP-T6-90-11B

Applied Code [EBARA STD.] 適用規格: SPS-1002-40

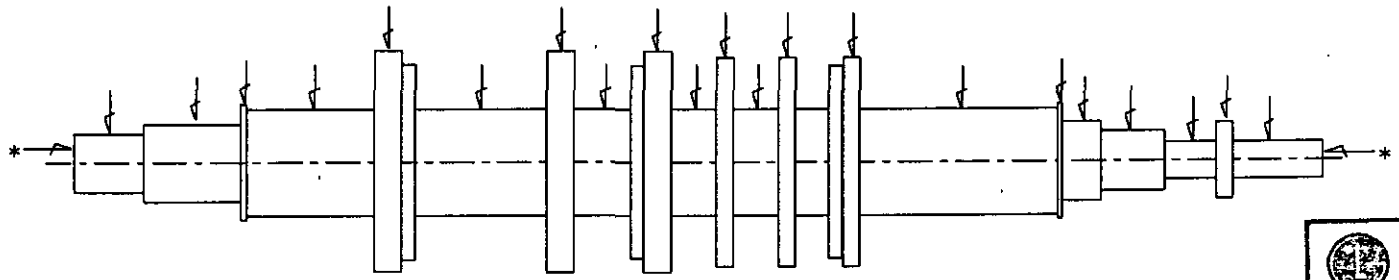
Test Method 試験方法	Search Unit 探触子	Specified Sensitivity 探傷感度
Normal Beam Technique 垂直法	24 φmm / 2 MHz	Height of B_1 echo BG : 50 mm
Angle Beam Technique 斜角法	— mm / MHz	—
Double crystal Technique 分割形探触子法	— φmm / MHz	—

Acceptance: 判定 ACCEPTABLE

Figure & Inspected Area 形状および探傷範囲

Shown by

R021570803
SRV-5DF
Item No.; CT-9901
B-Rotor
Part Name; Shaft



ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed

EETC Q.C Dept.

INSPECTION TEAM ☐WITNESSED ☒REVIEWED

LG E&C Y. Tsuchiumi Aug. 26, '03

PACIFIC STEEL MFG. CO., LTD. TOYAMA WORKS
大平洋製鋼株式会社 富山製造所

MAGNETIC PARTICLE INSPECTION REPORT
磁粉探傷試験成績表

Date 16 FEB. '03 Report No. 030250

Manufacturer's Order No. M02-12-040

Purchaser 御注文主 ELLIOTT EBARA TURBOMACHINERY CORPORATION

Name of Article 品名 SHAFT (For B-ROTOR)

Material 材質 ASTM A470 CL.4

Purchaser's Order No. 注文主番号 CD79967

Specification No.(仕様書No.) SMPS-ES-F15 REV.6 {EBARA STD.} Witness

Drawing No. 図番 ES/8601600 REV.0

Plant/Project

TYPE No. JSRV-5DF

WORK No. R021570803

Examined	Reviewed	Approved
J. Sakai.	—	
SNT-TC-1A LEVEL II	SNT-TC-1A LEVEL III	SNT-TC-1A LEVEL III

Piece No. 製品番号: 11181-204

QUANTITY 1

Conditions of Magnetic Particle Inspection 探傷条件

探傷器 Equipment: 電子磁気工業(株)Ez-3S Denshi Jiki Industry Co., Ltd, Ez-3S

Test Method 試験方法	Magnetizing Current 磁化電流	Magnetic Particles 磁粉(マークテック)	Prod Spacing プロッド間隔	Standard Test Piece 標準試験片
Prod Method プロッド法	DC 1000 A	Wet Fluorescent	200 mm	JIS G0565-A1 30/100
Yoke Method 極間法	—	—	—	—
Coil Method コイル法	DC 2100 A	Wet Fluorescent	—	JIS G0565-A1 30/100

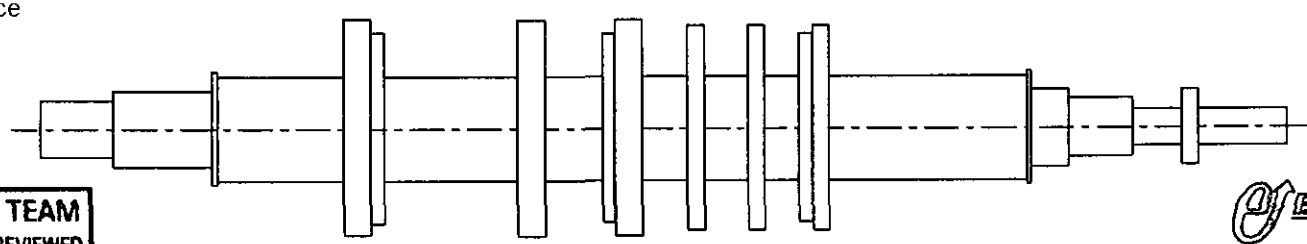
Procedure No. 要領書No. MIP-T6-90-11B

Applied Code {EBARA STD.} 適用規格 SPS-1002-22

Acceptance: 判定 ACCEPTABLE

Figure & Inspected Area 形状および探傷範囲

Entire Surface



ROZ1570803
SRV-5DF
Item No.; CT-9901
B-Rotor
Part Name; Shaft

INSPECTION TEAM
☐WITNESSED ☒REVIEWED
LG E&C J. Tsutsumi Aug 26. '03

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed
EETC Q.C Dept. T. Tokita

PACIFIC STEEL MFG. CO., LTD. TOYAMA WORKS
大平洋製鋼株式会社 富山製造所

HEAT STABILITY TEST REPORT
加 熱 振 れ 試 験 成 績 表

Order No. 受注番号 M02-12-040

date 日付 4 MAR. '03

Report No. 成績表番号 030250

Purchaser 御注文主	ELLIOTT EBARA TURBOMACHINERY CORPORATION
Neme of Article 品名	SHAFT
Material 材質	ASTM A470 CL.4
Purchaser'S Order No. 客先注文番号	CD79967
Drawing No. 図番	ES/8601600 REV.0
Name of Project プラント名、プロジェクト名	
TYPE No.	JSRV-5DF
WORK No.	R021570803

Applicable spec. {EBARA STD.}
適用仕様書
SMPS-ES-F15 REV.6
(SPS-1002-80)

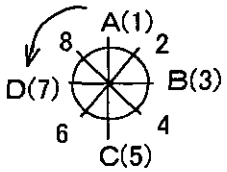
Acceptance Standard
判定基準
(振れ規格) Spec.Deflection 0.050 mm
(軸芯振れ) Spec.Vector 0.025 mm

Piece No. 製品番号 11181-204

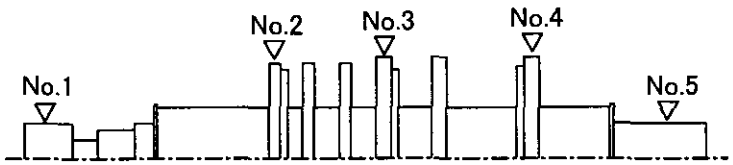
INSPECTION TEAM ☐WITNESSED ☒REVIEWED LG E&C Y. Tanisumi Aug. 26, '03

(試験条件) Test Condition
(昇温速度) Heating Rate 75 ℃/H
(保持温度) Holding 615 ℃
(保持時間) Holding Time 14 H
(降温速度) Cooling Rate Furnace Cooling

(温度と振れの測定器位置)
Measured Position of Temperture & Deflection



R021570803
SRV-5DF
Item No.; CT-9901
B-Rotor
Part Name; Shaft



第1回 低温測定 1ST COLD MEASUREMENTS UNIT : 1/1000 mm

Position		1				2				3				4				5			
Date	Time	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	-	-	-	-
2/24	15:00	0	0	0	0	0	0	5	5	0	0	0	5	0	0	0	5	0	0	0	0
	16:00	0	0	0	0	0	0	5	5	0	0	0	5	0	0	0	0	0	0	0	0
(A)	17:00	0	0	0	0	0	0	5	5	0	0	0	5	0	0	0	5	0	0	0	0
加熱時最終測定		FINAL HOT MEASUREMENTS																			
2/25	13:00	0	0	0	0	0	-5	-20	-10	0	-10	-20	-15	0	-15	-15	-10	0	0	0	0
	14:00	0	0	0	0	0	-10	-15	-10	0	-10	-20	-15	0	-10	-15	-10	0	0	0	0
(B)	15:00	0	0	0	0	0	-5	-20	-10	0	-10	-20	-15	0	-15	-15	-10	0	0	0	0
第2回 低温測定		2ND COLD MEASUREMENTS																			
2/26	22:00	0	0	0	0	0	-5	-20	-10	0	-10	-25	-15	0	-10	-15	-10	0	0	0	0
	22:30	0	0	0	0	0	-5	-20	-10	0	-10	-25	-15	0	-10	-15	-10	0	0	0	0
(C)	23:00	0	0	0	0	0	-5	-20	-10	0	-10	-20	-15	0	-10	-15	-10	0	0	0	0
(B),(C)の振れ差異		DEFLECTION BETWEEN																			
(B)		0	0	0	0	0	-5	-20	-10	0	-10	-20	-15	0	-15	-15	-10	0	0	0	0
(C)		0	0	0	0	0	-5	-20	-10	0	-10	-20	-15	0	-10	-15	-10	0	0	0	0
(B)−(C)		0	0	0	0	0	0	0	0	0	0	0	0	0	-5	0	0	0	0	0	0

結果 RESULT (Spec.Deflection)

0	0	0	5	0

ACCEPTANCE 判 定 ACCEPTABLE

☐ Witness 立会者
☐ Reviewer 確認者

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed EETC Q.C Dept.

Examined by 試験者 Y. Tanahara

Approved by 承認者 M. Sakiyama

PACIFIC STEEL MFG. CO., LTD. TOYAMA WORKS
大平洋製鋼株式会社 富山製造所

Report No. 030250
Unit: 1/1000mm

		DATE	TIME	Temp. (℃)	Position 1 A	1 B	1 C	1 D	2 A	2 B	2 C	2 D	3 A	3 B	3 C	3 D	4 A	4 B	4 C	4 D	5 A	5 B	5 C	5 D	Axie (mm)
1		2/24	15:00	11	0	0	0	0	0	0	5	5	0	0	0	5	0	0	0	5	0	0	0	0	0.0
2	FIRST COLD	2/24	16:00	12	0	0	0	0	0	0	5	5	0	0	0	5	0	0	0	0	0	0	0	0	0.0
3		2/24	17:00	11	0	0	0	0	0	0	5	5	0	0	0	5	0	0	0	5	0	0	0	0	0.0
4		2/24	18:00	76	0	0	0	0	0	5	5	10	0	0	5	15	0	5	5	10	0	0	0	0	0.1
5		2/24	19:00	151	0	0	0	0	0	0	5	10	0	0	5	10	0	0	5	10	0	0	0	0	0.5
6		2/24	20:00	225	0	0	0	0	0	0	10	15	0	0	5	10	0	0	5	10	0	0	0	0	1.6
7	HEATING	2/24	21:00	299	0	0	0	0	0	0	10	20	0	−5	5	15	0	0	5	15	0	0	0	0	3.2
8		2/24	22:00	374	0	0	0	0	0	−5	10	20	0	−5	5	20	0	0	5	15	0	0	0	0	5.5
9		2/24	23:00	449	0	0	0	0	0	0	5	15	0	0	5	10	0	0	5	10	0	0	0	0	8.0
10		2/24	0:00	524	0	0	0	0	0	−10	5	10	0	−5	5	20	0	0	10	15	0	0	0	0	10.0
11		2/25	1:00	600	0	0	0	0	0	−10	5	10	0	−10	5	15	0	0	5	5	0	0	0	0	11.5
12		2/25	2:00	616	0	0	0	0	0	−5	0	0	0	−5	0	0	0	−10	0	0	0	0	0	0	12.6
13		2/25	3:00	615	0	0	0	0	0	0	−5	−5	0	−5	−10	−5	0	−10	−10	−5	0	0	0	0	13.4
14		2/25	4:00	615	0	0	0	0	0	−5	−10	−5	0	−5	−15	−10	0	−15	−10	−10	0	0	0	0	14.0
15		2/25	5:00	616	0	0	0	0	0	−5	−10	−10	0	−10	−15	−10	0	−10	−10	−10	0	0	0	0	14.4
16		2/25	6:00	615	0	0	0	0	0	−5	−10	−10	0	−5	−15	−10	0	−10	−10	−10	0	0	0	0	14.7
17	HOLDING	2/25	7:00	615	0	0	0	0	0	−5	−10	−5	0	−5	−15	−10	0	−10	−15	−10	0	0	0	0	14.9
18		2/25	8:00	615	0	0	0	0	0	−5	−15	−10	0	−5	−15	−10	0	−20	−15	−10	0	0	0	0	15.0
19		2/25	9:00	615	0	0	0	0	0	−5	−15	−10	0	−10	−20	−15	0	−10	−15	−10	0	0	0	0	15.1
20		2/25	10:00	613	0	0	0	0	0	−5	−10	−10	0	−10	−20	−15	0	−10	−15	−10	0	0	0	0	15.1
21		2/25	11:00	613	0	0	0	0	0	−5	−20	−10	0	−10	−20	−10	0	−15	−15	−15	0	0	0	0	15.1
22		2/25	12:00	614	0	0	0	0	0	−5	−20	−10	0	−10	−20	−10	0	−20	−15	−15	0	0	0	0	15.1
23		2/25	13:00	613	0	0	0	0	0	−5	−20	−10	0	−10	−20	−15	0	−15	−15	−10	0	0	0	0	15.1
24	FINAL HOT	2/25	14:00	613	0	0	0	0	0	−10	−15	−10	0	−10	−20	−15	0	−10	−15	−10	0	0	0	0	15.1
25		2/25	15:00	614	0	0	0	0	0	−5	−20	−10	0	−10	−20	−15	0	−15	−15	−10	0	0	0	0	15.1
26		2/25	16:00	564	0	0	0	0	0	−5	−20	−10	0	−10	−25	−15	0	−20	−20	−15	0	0	0	0	14.9
27		2/25	17:00	502	0	0	0	0	0	−10	−20	−10	0	−15	−25	−15	0	−15	−15	−10	0	0	0	0	14.5
28		2/25	18:00	450	0	0	0	0	0	−10	−20	−10	0	−10	−25	−15	0	−20	−15	−10	0	0	0	0	14.0
	COOLING																								
29		2/26	22:00	18	0	0	0	0	0	−5	−20	−10	0	−10	−25	−15	0	−10	−15	−10	0	0	0	0	0.8
30	FINAL COLD	2/26	22:30	18	0	0	0	0	0	−5	−20	−10	0	−10	−25	−15	0	−10	−15	−10	0	0	0	0	0.8
31		2/26	23:00	18	0	0	0	0	0	−5	−20	−10	0	−10	−20	−15	0	−10	−15	−10	0	0	0	0	0.8

PACIFIC STEEL MFG. CO., LTD. TOYAMA WORKS
大平洋製鋼株式会社 富山製造所

INSPECTION TEAM
☐WITNESSED ☒REVIEWED
LG E&C
Aug. 26, '03

INSPECTION TEAM
☐WITNESSED ☒REVIEWED
LG E&C F. Buttussi Aug. 26 '03

TEST CERTIFICATE

HITACHI
Hitachi Metals. Ltd.
Yasugi Works

Customer: EBARA CORPORATION, SODEGAURA PLANT

Order No.: CB96375

Spec. No.	Material		Condition	Heat No.	2G222K1	Date	JUL. 04, 2000
SMPS-E1-R02 REV. 6	Size	AISI403 F19X29X2000L	HEAT TREATED	Number of Pieces	17	Report No.	007-0104-20
(EBARA STD.)				Mass	152 KGS	Our Ref. No.	158-G366-01

JOB. NO. : -

ROZ1570803
SRV-5DF
Item No : CT-9901
B-Rotor
Part Name; Blade (1st. stage)

Chemical Composition

Elements	C %	SI %	MN %	P %	S %	NI %	CR %	MO %
Spec.	0.09 -0.15	MAX 0.50	MAX 1.00	MAX 0.03	MAX 0.03	MAX 0.50	11.5 -13.0	MAX 0.20
LADLE	0.14	0.29	0.57	0.023	0.001	0.47	11.63	0.16
Elements								
Spec.								
LADLE								

Item	Hardness (as Shipped) PRODUCTS	Hardness (as Shipped) TEST PIECE	Hardness after Heat Treated HT		
Spec.	HB 201-248	HB 201-248	–	–	–
Result	229-229	229	TP	–	–
			–	–	–

Tensile Test at (RT)

Item	HT	TP	Yield Strength of 0.02%	Tensile Strength	Elongation (4D)	Reduction of Area
			N/MM2	N/MM2	%	%
Spec.	–	L	MIN 483	MIN 690	MIN 20	MIN 60
	–	–	–	–	–	–
Result	–	–	560	778	25.3	67.3
	–	–	–	–	–	–
Specimen	12.50D*50.0GL					

Tensile Test at (–)

HT	TP	Yield Strength of	Tensile Strength	Elongation ( )	Reduction of Area
		–	–	%	%
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
Specimen	–				

Stress Rupture Test

Item	HT	TP	Temperature	Stress	Life (Hrs)	Elongation	Reduction of Area
Spec.	–	–	–	–	–	–	–
Result	–	–	–	–	–	–	–
	–	–	–	–	–	–	–
	–	–	–	–	–	–	–

HT	Item	IMPACT TEST 2V NOTCH	RT

Macro Structure

Item	H			
Spec.	–	–	–	–
Result	–	–	–	–

Grain Size: Spec. – / TP –

Micro Structure

Item	HT	TP		
Spec.	–	–	–	–
Result	–	–	GOOD	–

Impact Test

	L	J			
Spec.	TP	MIN41			–
Result	–	183	174	177	–
	–	–	–	–	–
	–	–	–	–	–
	–	–	–	–	–

Heat Treatment

Delivered Condition (HTO)
R:Q. 960° CX20MIN. OQ
T. 715° CX1 h - AC

Test Specimen (HT) –

Attachment ☐ Yes ☒ No

Non-Metallic Inclusion

Item	TP													
Spec.	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Result	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Inspection Item	
Dimensional Test	GOOD
Visual Test	GOOD
Ultrasonic Test	GOOD
Magnetic Particle Test	GOOD
Liquid Penetrant Test	–
Material Check	–

Conforms To All Drawing and/or Specification Requirements.
We hereby certify that the material described herein has been made and tested in accordance with the requirements of the purchase specification with satisfactory results.

S. Yoshikawa

QUALITY ASSURANCE DEPARTMENT

PROJECT: –

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed

EETC Q.C Dept. T. Tada

INSPECTION TEAM
☐ WITNESSED ☒ REVIEWED
LG E&C
Aug 26, '03

TEST CERTIFICATE

HITACHI
Hitachi Metals. Ltd.
Yasugi Works

Customer: EBARA CORPORATION, ~~SODEGAURA PLANT~~

Order No.: CB96375

Spec. No.	Material	AISI403	Condition	Heat No.	2G222K5	Date	JUL. 04, 2000
SMPS-E1-R02 REV. 6 (EBARA STD.)	Size	F19X29X2000L	HEAT TREATED	Number of Pieces	10	Report No.	007-0102-90
		JOB. NO.: -		Mass	91 KGS	Our Ref. No.	158-G366-01

Chemical Composition

Elements	C %	SI %	MN %	P %	S %	NI %	CR %	MO %
Spec.	0.09 -0.15	MAX 0.50	MAX 1.00	MAX 0.03	MAX 0.03	MAX 0.50	11.5 -13.0	MAX 0.20
LADLE	0.14	0.29	0.57	0.023	0.001	0.47	11.63	0.16

R0Z1570803
SRV-5DF
Item No.: CT-9901
B-Rotor
Part Name: Blade (1st. stage)

Item	Hardness (as Shipped) PRODUCTS	Hardness (as Shipped) TEST PIECE	HT	Hardness after Heat Treated	
Spec.	HB 201-248	HB 201-248	TP	-	-
Result	241- 241	241	-	-	-

Tensile Test at (RT)

Item	HT/TP	Yield Strength of 0.02%	Tensile Strength	Elongation (4D)	Reduction of Area
Spec.		N/MM2	N/MM2	%	%
	L	MIN 483	MIN 690	MIN 20	MIN 60
		-	-	-	-
Result		572	780	24.7	67.3
		-	-	-	-
Specimen	12.50D*50.0GL				

Tensile Test at (-)

Item	HT/TP	Yield Strength of	Tensile Strength	Elongation ( )	Reduction of Area
Spec.		-	-	%	%
		-	-	-	-
		-	-	-	-
Result		-	-	-	-
Specimen	-				

Stress Rupture Test

Item	HT	TP	Temperature	Stress	Life (Hrs)	Elongation	Reduction of Area
Spec.		-	-	-	-	-	-
Result		-	-	-	-	-	-
		-	-	-	-	-	-

Macro Structure

Item						Grain Size	Spec.	
Spec.	-	-	-	-	-	TP	-	-
Result	-	-	-	-	-		-	-

Micro Structure

Item	HT/TP		
Spec.	-	-	-
Result	-	GOOD	-

Impact Test

Specimen	HT	Item	IMPACT TEST 2V NOTCH			RT
Spec.	L		J MIN41			-
	TP	-	-	-	-	
Result	-	177	169	172	-	
	-	-	-	-	-	
	-	-	-	-	-	
	-	-	-	-	-	

Heat Treatment

Delivered Condition (HTO)
R:Q. 960°CX20MIN. OQ
T. 715°CX1 h AC

Test Specimen (HT): -

Attachment ☐ Yes ☒ No

Non-Metallic Inclusion

Item	TP	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spec.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Result	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Inspection Item

Inspection Item	
Dimensional Test	GOOD
Visual Test	GOOD
Ultrasonic Test	GOOD
Magnetic Particle Test	GOOD
Liquid Penetrant Test	-
Material Check	-

Conforms To All Drawing and/or Specification Requirements.
We hereby certify that the material described herein has been made and tested in accordance with the requirements of the purchase specification with satisfactory results.

S. Yoshikawa
QUALITY ASSURANCE DEPARTMENT

PROJECT: -

ELLIOTT EBARA GROUP
☐ Witnessed
☒ Reviewed
EETC Q.C Dept.

'00. 7. 6

TEST CERTIFICATE

HITACHI
Hitachi Metals. Ltd.
Yasugi Works

Customer: EBARA CORPORATION, SODEGAURA PLANT

Order No.: CC74113

Spec. No.	Material	AISI403	Condition	Heat No.	2K375S4	Date	DEC. 26, 2001
SMPS-E1-R02 REV. 6	Size	F23X26X2000L	HEAT TREATED	Number of Pieces	99	Report No.	112-2413-70
(EBARA STD.)				Mass	996 KGS	Our Ref. No.	158-L740-02

JOB. NO. : -

ROZ1570803
SRV-5DF
Item No.: CT-9901
B-Rotor
Part Name; Blade (2nd. stage)

Chemical Composition

Elements	C %	SI %	MN %	P %	S %	NI %	CR %	MO %
Spec.	0.09 -0.15	MAX 0.50	MAX 1.00	MAX 0.03	MAX 0.03	MAX 0.50	11.5 -13.0	MAX 0.20
LADLE	0.12	0.23	0.56	0.021	0.001	0.48	11.63	0.17
Elements								
Spec.								
LADLE								

Item	Hardness (as Shipped) PRODUCTS	Hardness (as Shipped) TEST PIECE	Hardness after Heat Treated HT		
Spec.	HB 201-248	HB 201-248	-		
Result	235-235	235	TP	-	-
			-	-	-

Tensile Test at (RT)

Item	HT	TP	Yield Strength of 0.02%	Tensile Strength	Elongation (4D)	Reduction of Area
			N/MM2	N/MM2	%	%
Spec.	-	L	MIN 483	MIN 690	MIN 20	MIN 60
	-	-	-	-	-	-
Result	-	-	540	749	26.6	71.5
	-	-	-	-	-	-
Specimen	12.50D*50.0GL					

Tensile Test at (-)

HT	TP	Yield Strength of	Tensile Strength	Elongation ( )	Reduction of Area
		-	-	%	%
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
Specimen		-			

Stress Rupture Test

Item	HT	TP	Temperature	Stress	Life (Hrs)	Elongation	Reduction of Area
Spec.	-	-	-	-	-	-	-
Result	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-

Micro Structure

Item	HT	TP		
Spec.	-	-	-	-
Result	-	-	GOOD	-

Impact Test

		L	J			
Spec.		TP	MIN41			-
Result		-	163	162	148	-
		-	-	-	-	-
		-	-	-	-	-
		-	-	-	-	-

HT Item: IMPACT TEST 2V NOTCH RT

Macro Structure

Item	TP				
Spec.	-	-	-	-	-
Result	-	-	-	-	-

Grain Size

	-		
Spec. TP	-	-	-

Heat Treatment

Delivered Condition (HTO)
R:Q. 960° CX30MIN. OQ
T. 715° CX1 h AC

Test Specimen (HT)
-

Attachment ☐ Yes ☒ No

Non-Metallic Inclusion

Item	TP												
		-	-	-	-	-	-	-	-	-	-	-	-
Spec.	-	-	-	-	-	-	-	-	-	-	-	-	-
Result	-	-	-	-	-	-	-	-	-	-	-	-	-

Inspection Item

Dimensional Test	GOOD
Visual Test	GOOD
Ultrasonic Test	GOOD
Magnetic Particle Test	GOOD
Liquid Penetrant Test	-
Material Check	GOOD

PROJECT: -

LG E&C
INSPECTION TEAM
☐ WITNESSED ☒ REVIEWED
Aug. 26, '03

ELLIOTT ECARA GROUP ☐ Witnessed ☑ Reviewed
EETC Q.C Dept.

Conforms To All Drawing and/or Specification Requirements.
We hereby certify that the material described herein has been made and tested in accordance with the requirements of the purchase specification with satisfactory results.

S. Yoshikawa
QUALITY ASSURANCE DEPARTMENT

ROZ1570803
SRV-5DF
Item No.: CT-9901
B-Rotor
Part Name: Blade (3rd. stage)

試験成績表
TEST CERTIFICATE

御中

INSPECTION TEAM
☐WITNESSED ☒REVIEWED
LG E&C J. Tsutsumi Aug. 26, '03

HITACHI
Hitachi Metals. Ltd.
Yasugi Works

御注文主:EBARA CORPORATION, SODEGAURA PLANT
Customer

御注文番号:CC89009
Order No.

スペック番号 Spec.No.	鋼種 Material		納入状態 Condition	溶解番号 Heat No.		発行日 Date	
SMPS-E1-R04 REV.5 【EBARA STD.】	寸法 Size	ASTM A565 GR.616 F23X26X2000L	HEAT TREATED	個数 Number of Pieces	38	成績表番号 Report No.	202-2510-10
				質量 Mass	382 KGS	参照 Our Ref.No.	158-M582-04

製番 (JOB. NO.) :R001600302

化学成分 Chemical Composition

元素名 Elements	C %	SI %	MN %	P %	S %	NI %	CR %	W %	MO %	V %	CO %	AL %	SN %	TI %
規格 Spec.	0.20 -0.25	0.20 -0.50	0.50 -1.00	MAX 0.025	MAX 0.025	0.50 -1.00	11.00 -12.50	0.90 -1.25	0.90 -1.25	0.20 -0.30	MAX 0.25	MAX 0.05	MAX 0.04	MAX 0.05
LADLE	0.22	0.25	0.80	0.019	0.001	0.81	11.08	0.91	0.91	0.20	0.04	0.003	0.001	0.004

項目 Item	納入硬さ Hardness (as Shipped) 製品	試験片	熱処理硬さ Hardness after Heat Treated HT		地疵又は清浄度 Macro-Streak-Flaw or Cleanliness 規格 Spec.			項目 Item	T	P
規格 Spec.	HB 255-331	HB	—	—	段 Step T	—	—	—	規格 Spec.	—	—
			TP	—	P		—			
結果 Result	302-302	302	—	—	結果 Result —	—	—	—	結果 Result	—	—

引張試験 Tensile Test at (RT) HT

項目 Item	HT	TP	耐力 降伏点 P.Str at 0.2%	引張強さ Tensile Strength	伸び Elong. (4D)	絞り Red.of Area
			N/MM2	N/MM2	%	%
規格 Spec.	—	L	MIN 690	MIN 863	MIN 15	MIN 45
	—		—	—	—	—
結果 Result	—	—	829	1002	17.0	48.2

試験片 Specimen 12.50D*50.0GL

衝撃試験 Impact Test.

項目 Item					
規格 Spec.	—	TP	—	—	—
結果 Result	—	—	—	—	—

焼入性 Hardenability

	HT	TP			
規格 Spec.	—		—	—	—
結果 Result	—	—	—	—	—

クリープ試験 Stress Rupture

項目 Item	HT	TP	温度 Temp.	応力 Stress	寿命 Life (Hrs)	伸び El.(%)	絞り (%) Red.of Area
規格 Spec.	—	—	—	—	—	—	—
結果 Result	—	—	—	—	—	—	—

熱処理 Heat Treatment
納入状態 Delivered Condition (HTO)
R:Q. 1038°C X30MIN. OQ
T. 660°C X1 h AC

試験片 Test Specimen (HT)

ELLIOTT EBARA GROUP ☐Witnessed ☒Reviewed
EETC Q.C Dept.

マクロ組織 Macro Structure

項目 Item				
規格 Spec.	—	—	—	—
結果 Result	GOOD	—	—	—

結晶粒度 Grain Size

項目 Item	Spec. TP		
規格 Spec.	—	—	—
結果 Result	—	—	—

脱炭又は表面汚染 Decarburization or Surface Contamination

項目 Item				
規格 Spec.	HT	TP	—	—
結果 Result	—	—	—	—

検査項目 Inspection Item

寸法検査	:Dimensional Test	GOOD
外観検査	:Visual Test	GOOD
超音波検査	:Ultrasonic Test	GOOD
磁気探傷検査	:Magnetic Particle Test	GOOD
浸透探傷検査	:Liquid Penetrant Test	—
材質確認	:Material Check	GOOD

ミクロ組織 Micro Structure

項目 Item	HT	TP			
規格 Spec.	—	—	—	—	—
結果 Result	—	GOOD	—	—	—

非金属介在物 Non-Metallic Inclusion

T P	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	—	—

添付資料 Attachment ☒有 Yes ☐無 No

要求図面/仕様書に適合する。
Conforms To All Drawing and/or Specification Requirements.
この材料は、注文規格の要求を満足していることを証明します。
We hereby certify that the material described herein has been made and tested in accordance with the requirements of the purchase specification with satisfactory results.

QUALITY ASSURANCE DEPARTMENT

プラント名 (PROJECT) :2SNV-8

ROZ1570803
SRV-5DF
Item No.; CT-9901
B-Rotor
Part Name: Blade (3rd. stage)

TEST CERTIFICATE

INSPECTION TEAM
☐WITNESSED ☒REVIEWED
LG E&C J. Tsutsumi Aug 26'03

HITACHI
Hitachi Metals. Ltd.
Yasugi Works

Customer: EBARA CORPORATION, SODEGAURA PLANT

Order No.: CB77298

Spec. No.	Material	ASTM A565 GR.616	Condition	Heat No.	9J65ISI	Date	MAR. 18, 2000
SMPS-E1-R04 REV. 4	Size	F23X26X2000L	HEAT TREATED	Number of Pieces	7	Report No.	003-1712-00
(EBARA STD.)				Mass	71 KGS	Our Ref. No.	158-F185-01

JOB. NO.: R990430303

Chemical Composition

Elements	C %	SI %	MN %	P %	S %	NI %	CR %	W %	MO %	V %	CO %	AL %	SN %	TI %
Spec.	0.20 -0.25	0.20 -0.50	0.50 -1.00	MAX 0.025	MAX 0.025	0.50 -1.00	11.00 -12.50	0.90 -1.25	0.90 -1.25	0.20 -0.30	MAX 0.25	MAX 0.05	MAX 0.04	MAX 0.05
LADLE	0.23	0.29	0.79	0.019	0.001	0.79	11.42	0.93	0.94	0.24	0.05	0.008	0.001	0.005

Item	Hardness (as Shipped) PRODUCTS	Hardness (as Shipped) TEST PIECE	Hardness after Heat Treated HT	Hardness after Heat Treated TP
Spec.	HB 255-331	HB	–	–
Result	311-311	311	–	–

Macro-Streak-Flaw or Cleanliness

Item				
Spec.		–	–	–
Step	T P	–	–	–
Result	–	–	–	–

Item	HT	TP	–	–
Spec.			–	–
Result			–	–

Tensile Test at (RT)

Item	HT	TP	Yield Strength or 0.2% N/MM2	Tensile Strength N/MM2	Elongation (4D) %	Reduction of Area %
Spec.		L	MIN 690	MIN 863	MIN 15	MIN 45
			–	–	–	–
Result			851	1022	18.8	51.0
Specimen	12.50D*50.0GL					

HT Impact Test at

Item					
	–				
Spec.	–		–		–
	TP	–	–	–	
Result	–	–	–	–	–

Hadenability

	HT	TP			
Spec.			–	–	–
Result			–	–	–

Stress Rupture

Item	HT	TP	Temperature	Stress	Life (Hrs)	Elongation(%)	Reduction of Area
Spec.	–	–	–	–	–	–	–
Result	–	–	–	–	–	–	–

Heat Treatment

Delivered Condition(HTO) Test Specimen (HT)
R:Q. 1038° CX30MIN. OQ
T. 660° CX1 h AC

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed

EETC Q.C Dept. T. Tokita

Macro Structure

Item	HT	TP			
Spec.	–	–	–	–	–
Result	–	GOOD	–	–	–

Grain Size

Item	Spec. TP		
		–	
Spec.		–	–
Result	–	–	–

Decarburization or Surface Contamination

Item				
		–	–	–
Spec.	HT TP	–	–	–
Result		–	–	–

Micro Structure

Item	HT	TP			
Spec.	–	–	–	–	–
Result	–	–	–	–	–

Non-Metallic Inclusion

					–				–						
	TP					–	–	–	–	–	–	–	–	–	–
Spec.		–	–	–	–	–	–	–	–	–	–	–	–	–	–
Result		–	–	–	–	–	–	–	–	–	–	–	–	–	–

Inspection Item

Dimensional Test	GOOD
Visual Test	GOOD
Ultrasonic Test	GOOD
Magnetic Particle Test	GOOD
Liquid Penetrant Test	–
Material Check	–

Attachment ☒ Yes ☐ No

Conforms to All Drawing and/or Specification Requirements.
We hereby certify that the material described herein has been made and tested in accordance with the requirements of the purchase specification with satisfactory results.

S. Yoshikawa.
QUALITY ASSURANCE DEPARTMENT

PROJECT: SBEG-5 DC

ROZ1570803
SRV-5DF
Item No.: CT-9901
B-Rotor
Part Name: Blade (3rd. stage)

TEST CERTIFICATE

HITACHI
Hitachi Metals. Ltd.
Yasugi Works

Customer: EBARA CORPORATION, SODEGAURA PLANT

Order No.: CC21394

LG F&C
INSPECTION TEAM
☐ WITNESSED ☒ REVIEWED
J. Tsutsumi Aug 26, '03

Spec. No.	Material	ASTM A565 GR.616	Condition	Heat No.	9M045S1	Date	JAN. 08, 2001
SMPS-E1-R04 REV.4 (EBARA STD.)	Size	F23X26X2000L	HEAT TREATED	Number of Pieces	13	Report No.	012-2616-20
				Mass	133 KGS	Our Ref. No.	158-H648-01
	JOB. NO.: R991119103						

Chemical Composition

Elements	C %	SI %	MN %	P %	S %	NI %	CR %	W %	MO %	V %	CO %	AL %	SN %	TI %
Spec.	0.20 -0.25	0.20 -0.50	0.50 -1.00	MAX 0.025	MAX 0.025	0.50 -1.00	11.00 -12.50	0.90 -1.25	0.90 -1.25	0.20 -0.30	MAX 0.25	MAX 0.05	MAX 0.04	MAX 0.05
LADLE	0.22	0.26	0.78	0.021	0.001	0.81	11.44	0.93	0.95	0.23	0.03	0.009	0.002	0.004

Item	Hardness (as Shipped) PRODUCTS	Hardness (as Shipped) TEST PIECE	Hardness after Heat Treated HT	Hardness after Heat Treated TP	Macro-Streak-Flaw or Cleanliness Spec.	Step	T P	Item	H T	T P
Spec.	HB 255-331	HB	–	–	–	–	–	Spec.	–	–
Result	311-311	311	–	–	–	–	–	Result	–	–

Tensile Test at (RT)

Item	HT	TP	Yield Strength or 0.2%	Tensile Strength	Elongation (4D)	Reduction of Area
			N/MM2	N/MM2	%	%
Spec.	–	L	MIN 690	MIN 863	MIN 15	MIN 45
	–	–	–	–	–	–
Result	–	–	851	1020	18.2	50.4
Specimen	12.50D*50.0GL					

Impact Test at HT

Item	HT	TP			
Spec.	–	TP	–	–	–
Result	–	–	–	–	–

Hadenability

	HT	TP			
Spec.	–	–	–	–	–
Result	–	–	–	–	–

Stress Rupture

Item	HT	TP	Temperature	Stress	Life (Hrs)	Elongation(%)	Reduction of Area
Spec.	–	–	–	–	–	–	–
Result	–	–	–	–	–	–	–

Heat Treatment
Delivered Condition(HTO) Test Specimen (HT)
R:Q.1038°CX30MIN. OQ
T.660°CX1 h AC

ELLIOTT EBARA GROUP ☐ Witnessed ☒ Reviewed

EETC Q.C Dept.

Macro Structure

Item	TP				
Spec.	–	–	–	–	–
Result	–	GOOD	–	–	–

Grain Size HT

Item	Spec. TP		
Spec.	–	–	–
Result	–	–	–

Decarburization or Surface Contamination

Item	HT	TP			
Spec.	–	–	–	–	–
Result	–	–	–	–	–

Inspection Item

Dimensional Test	GOOD
Visual Test	GOOD
Ultrasonic Test	GOOD
Magnetic Particle Test	GOOD
Liquid Penetrant Test	–
Material Check	–

Micro Structure

Item	HT	TP			
Spec.	–	–	–	–	–
Result	–	–	–	–	–

Non-Metallic Inclusion

	TP													
	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Attachment ☒ Yes ☐ No

Conforms To All Drawing and/or Specification Requirements.
We hereby certify that the material described herein has been made and tested in accordance with the requirements of the purchase specification with satisfactory results.

S. Yoshikawa
QUALITY ASSURANCE DEPARTMENT

PROJECT: SBEG-4

INSPECTION TEAM
☐WITNESSED ☒REVIEWED
LG E&C J. Bautista Aug 26, '03

試験成績表
TEST CERTIFICATE

HITACHI
Hitachi Metals. Ltd.
Yasugi Works

御注文主: (株) 荏原エリオット
Customer 本社

御中

御注文番号:CD20033
Order No.

スペック番号 Spec.No.	鋼種 Material	12CR-0.12CB-MOD	納入状態 Condition	溶解番号 Heat No.	9K447K1	発行日 Date	2002-08-07
SMPS-EI-R06 REV.4	寸法 Size	F24X35X2000L	HEAT TREATED	個数 Number of Pieces	16	成績表番号 Report No.	207-3104-70
[EBARA STD.]				質量 Mass	222 KGS	参照 Our Ref.No.	151-NA7P-01

製番 (JOB. NO.) :R010871403

R021570803
SRV-5
Item No.; CT-9901
B-Rotor
Part Name: Blade (4th. stage)

化学成分 Chemical Composition

元素名 Elements	C %	SI %	MN %	P %	S %	NI %	CR %	NB %
規格 Spec.	0.13 -0.18	MAX 0.50	0.40 -0.60	MAX 0.025	MAX 0.010	MAX 0.50	11.50 -13.00	0.15 -0.25
LADLE	0.14	0.36	0.48	0.021	0.002	0.41	12.17	0.20

項目 Item	納入硬さ Hardness (as Shipped) 製品	試験片	熱処理硬さ Hardness after Heat Treated			地疵又は清浄度 Macro-Streak-Flaw or Cleanliness			
			HT	–	–	規格 Spec.	–	–	–
規格 Spec.	HB 255-302	HB 255-302	–			段 Step T	–	–	–
			TP	–	–	P	–		
結果 Result	269-269	269	–	–	–	結果 Result –	–	–	–

項目 Item		–	–
規格 Spec.	T	–	–
	P		
結果 Result	T	–	–
	P		

引張試験 Tensile Test at (RT)

項目 Item	H/T T/P	耐力 降伏点 0.2% Str.	引張強さ Tensile Strength	伸び Elong. (4D)	絞り Red.of Area
		N/MM2	N/MM2	%	%
規格 Spec.	L	MIN 690	MIN 828	MIN 17	MIN 55
	–	–	–	–	–
結果 Result	–	764	892	20.9	66.2

試験片 Specimen 12.50D*50.0GL

HT 衝撃試験 Impact Test

項目 Item	衝撃試験 2V NOTCH				RT
規格 Spec.	L	J MIN54			–
	TP	–	–	–	
結果 Result	–	127	109	106	–

焼入性 Hardenability	規格 Spec.	H/T T/P	–	–	–
	結果 Result	–	–	–	–

応力破断試験 Stress Rupture	項目 Item	H/T	T P	温度 Temp.	応力 Stress	寿命 Life (Hrs)	伸び El.(%)	絞り (%) Red.of Area
	規格 Spec.	–	–	–	–	–	–	–
	結果 Result	–	–	–	–	–	–	–

熱処理 Heat Treatment

納入状態 Delivered Condition(HTO) 試験片 Test Specimen (HT)

R:Q.960°CX30MIN. OQ
T.610°CX1 h AC

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed

EETC Q.C Dept. T. Tashi

マクロ組織 Macro Structure

項目 Item	H/T T/P				
規格 Spec.	–	–	–	–	–
結果 Result	–	–	–	–	–

結晶粒度 Grain Size

項目 Item	Spec. TP		
規格 Spec.	–	–	–
結果 Result	–	–	–

脱炭又は表面汚染 Decarburization or Surface Contamination

項目 Item		–	–	–
規格 Spec.	H/T T/P	–	–	–
結果 Result		–	–	–

検査項目 Inspection Item

寸法検査	:Dimensional Test	GOOD
外観検査	:Visual Test	GOOD
超音波検査	:Ultrasonic Test	GOOD
磁気探傷検査	:Magnetic Particle Test	GOOD
浸透探傷検査	:Liquid Penetrant Test	–
材質確認	:Material Check	GOOD

ミクロ組織 Micro Structure

項目 Item	H/T T/P			
規格 Spec.	–	–	–	–
結果 Result	–	GOOD	–	–

非金属介在物 Non-Metallic Inclusion

				–				–						
T P	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	–	–	–	–	–	–	–	–	–	–	–	–	–	–

添付資料 Attachment ☒有 Yes ☐無 No

要求図面/仕様書に適合する。
Conforms To All Drawing and/or Specification Requirements.
この材料は、注文規格の要求を満足していることを証明します。
We hereby certify that the material described herein has been made and tested in accordance with the requirements of the purchase specification with satisfactory results.

QUALITY ASSURANCE DEPARTMENT

'02.8.21 03982

プラント名 (PROJECT) :SBEG-4

INSPECTION TEAM
☐WITNESSED ☒REVIEWED
LG E&C J. Tsutsumi Aug 26, '03

試験成績表
TEST CERTIFICATE

御中

HITACHI
Hitachi Metals. Ltd.
Yasugi Works

注文主: (株) 荏原エリオット
Customer 本社

注文番号:CD80935
Order No.

スペック番号 Spec.No.	鋼種 Material	12CR-0.12CB-MOD	納入状態 Condition	溶解番号 Heat No.	9S018K1	発行日 Date	2003-03-25
SMPS-ET-R06 REV.4 {EBARA STD.}	寸法 Size	F40X45X2000L	HEAT TREATED	個数 Number of Pieces	14	成績表番号 Report No.	303-1411-90
				質量 Mass	414 KGS	参照 Our Ref.No.	151-PSWF-01

製番 (JOB. NO.) :R021570803

ROZ1570803
SRV-5DF
Item No.: CT-9901
B-Rotor
Part Name; Blade (5th, 5DFth. Stage)

化学成分 Chemical Composition

元素名 Elements	C %	SI %	MN %	P %	S %	NI %	CR %	NB %
規格 Spec.	0.13 -0.18	MAX 0.50	0.40 -0.60	MAX 0.025	MAX 0.010	MAX 0.50	11.50 -13.00	0.15 -0.25
LADLE	0.15	0.27	0.51	0.019	0.003	0.38	12.04	0.20

項目 Item	納入硬さ Hardness (as Shipped) 製品	試験片	熱処理硬さ Hardness after Heat Treated HT		地疵又は清浄度 Macro-Streak-Flaw or Cleanliness
規格 Spec.	HB 255-302	HB 255-302	–	–	規格 Spec. –
結果 Result	277-277	277	–	–	段 Step T – P – 結果 Result –

引張試験 Tensile Test at (RT)

項目 Item	HT	TP	耐力 0.2%耐力 Str.at 0.2%	引張強さ Tensile Strength	伸び Elong. (4D)	絞り Red.of Area
			N/MM2	N/MM2	%	%
規格 Spec.	–	L	MIN 690	MIN 828	MIN 17	MIN 55
	–	–	–	–	–	–
結果 Result	–	–	747	878	21.2	65.9

試験片 Specimen 12.50D*50.0GL

衝撃試験 Impact Test

項目 Item	衝撃試験 2V NOTCH RT			
規格 Spec.	L	J MIN54		–
	TP	–	–	–
結果 Result	–	119	117	116

焼入性 Hardenability

	HT	TP			
規格 Spec.			–	–	–
結果 Result	–	–	–	–	–

ｽﾄﾚｽ試験 Stress Rupture

項目 Item	HT	TP	温度 Temp.	応力 Stress	寿命 Life (Hrs)	伸び El.(%)	絞り (%) Red.of Area
規格 Spec.	–	–	–	–	–	–	–
結果 Result	–	–	–	–	–	–	–

熱処理 Heat Treatment
納入状態 Delivered Condition(HTO) 試験片 Test Specimen (HT)
R:Q.960°CX30MIN. OQ
T.610°CX2 h AC

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed
EETC Q.C Dept. T. Tokk

項目 Item	マクロ組織 Macro Structure HT	TP			
規格 Spec.	–	–	–	–	–
結果 Result	–	–	–	–	–

結晶粒度 Grain Size –

項目 Item	Spec TP		
規格 Spec.	–	–	
結果 Result	–	–	–

脱炭又は表面汚染 Decarburization or Surface Contamination –

項目 Item			
規格 Spec.	HT TP –	–	–
結果 Result	–	–	–

検査項目 Inspection Item

寸法検査 :Dimensional Test	GOOD
外観検査 :Visual Test	GOOD
超音波検査 :Ultrasonic Test	GOOD
磁気探傷検査 :Magnetic Particle Test	GOOD
浸透探傷検査 :Liquid Penetrant Test	–
材質確認 :Material Check	GOOD

ミクロ組織 Micro Structure

項目 Item	HT	TP			
規格 Spec.	–	–	–	–	–
結果 Result	–	–	GOOD	–	–

非金属介在物 Non-Metallic Inclusion –

	TP													
	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	–	–	–	–	–	–	–	–	–	–	–	–	–	–

添付資料 Attachment ☒有 Yes ☐無 No

要求図面/仕様書に適合する。
Conforms To All Draving and/or Specification Requirements.
この材料は、注文規格の要求を満足していることを証明します。
We hereby certify that the material described herein has been made and tested in accordance with the requirements of the purchase specification with satisfactory results.

QUALITY ASSURANCE DEPARTMENT

プラント名 (PROJECT) :SRV-5DF(ヨビローター)

INSPECTION TEAM
☐WITNESSED ☒REVIEWED
LG E&C
Y. Tsutsumi
Aug. 26, '03

試験成績表
TEST CERTIFICATE

HITACHI
Hitachi Metals. Ltd.
Yasugi Works

御注文主: (株) 荏原エリオット 御中
Customer 本社

御注文番号: CD80935
Order No.

スペック番号 Spec. No.	SMPS-EI-R06 REV. 4 (EBARA STD.)	溶解番号 Heat No.	9P828N1
鋼種 Material	12CR-0.12CB-MOD	個数 Number of Pieces	16
寸法 Size	F40X45X2000L	質量 Mass	470 KGS
納入状態 Condition	HEAT TREATED	発行日 Date	2003-03-25
製番 (JOB. NO.)	:R021570803	成績表番号 Report No.	303-1834-30
		参照 Our Ref. No.	151-PSWF-01

化学成分 Chemical Composition

元素名 Elements	C %	SI %	MN %	P %	S %	NI %	CR %	NB %
規格 Spec.	0.13 -0.18	MAX 0.50	0.40 -0.60	MAX 0.025	MAX 0.010	MAX 0.50	11.50 -13.00	0.15 -0.25
LADLE	0.15	0.34	0.50	0.019	0.001	0.39	12.04	0.20

R021570803
SRV-5DF
Item No: CT-9901
B-Rotor
Part Name: Blade (5th., 5DFth. stage)

項目 Item	納入硬さ Hardness (as Shipped) 製品	試験片	HT	熱処理硬さ Hardness after Heat Treated	
規格 Spec.	HB 255-302	HB 255-302	– / TP	–	–
結果 Result	277-277	277	–	–	–

地疵又は清浄度 Macro-Streak-Flaw or Cleanliness

規格 Spec. 段 Step	T P	–	–	–
結果 Result	–	–	–	–

項目 Item	HT TP	–	–
規格 Spec.	–	–	–
結果 Result	–	–	–

引張試験 Tensile Test at (RT)

項目 Item	HT TP	耐力 耐力(永久歪) Pr. Str. ε0.2%	引張強さ Tensile Strength	伸び Elong. (4D)	絞り Red. of Area
		N/MM2	N/MM2	%	%
規格 Spec.	L	MIN 690	MIN 828	MIN 17	MIN 55
		–	–	–	–
結果 Result	–	757	892	21.6	61.1

試験片 Specimen 12.50D*50.0GL

HT 衝撃試験 Impact Test

項目 Item	衝撃試験 2V NOTCH RT				
規格 Spec.	L	J MIN54			–
	TP	–	–	–	
結果 Result	–	86	91	76	–

焼入性 Hardenability	規格 Spec.	HT TP	–	–
	結果 Result	–	–	–

ｸﾘｰﾌﾟ･ﾗﾌﾟﾁｬｰ試験 Stress Rupture	項目 Item	HT	T P	温度 Temp.	応力 Stress	寿命 Life (Hrs)	伸び El. (%)	絞り (%) Red. of Area
	規格 Spec.		–	–	–	–	–	–
	結果 Result		–	–	–	–	–	–

熱処理 Heat Treatment

納入状態 Delivered Condition (HTO) R: Q. 960°CX30MIN. OQ T. 610°CX2 h AC

試験片 Test Specimen (HT) –

ELLIOTT EBARA GROUP
☐Witnessed
☒Reviewed
EETC Q.C Dept.

項目 Item	マクロ組織 Macro Structure			
規格 Spec.	–	–	–	–
結果 Result	–	–	–	–

HT	結晶粒度 Grain Size		
項目 Item / 規格 Spec. TP	–	–	–
結果 Result	–	–	–

脱炭又は表面汚染 Decarburization or Surface Contamination			
項目 Item	–	–	–
規格 Spec. HT TP	–	–	–
結果 Result	–	–	–

検査項目 Inspection Item		
寸法検査	Dimensional Test	GOOD
外観検査	Visual Test	GOOD
超音波検査	Ultrasonic Test	GOOD
磁気探傷検査	Magnetic Particle Test	GOOD
浸透探傷検査	Liquid Penetrant Test	–
材質確認	Material Check	GOOD

項目 Item	HT TP	ミクロ組織 Micro Structure		
規格 Spec.	–	–	–	–
結果 Result	–	GOOD	–	–

非金属介在物 Non-Metallic Inclusion					
T P	–	–	–	–	–
	–	–	–	–	–

添付資料 Attachment ☒有 Yes ☐無 No

要求図面/仕様書に適合する。
Conforms To All Drawing and/or Specification Requirements.
この材料は、注文規格の要求を満足していることを証明します。
We hereby certify that the material described herein has been made and tested in accordance with the requirements of the purchase specification with satisfactory results.
QUALITY ASSURANCE DEPARTMENT

プラント名 (PROJECT) :SRV-5DF (ヨビローター)

SUBJECT	STEAM TURBINE / MAGNETIC PARTICLE EXAMINATION RECORD		
EBARA SER. No.	R021570803	MODEL SRV-5DF	ITEM No. CT-9901
MACHINE No.	-		

Part Name	Exhaust end casing
Part No.	-
Quantity	1

■ Table : Condition

Joint No.	As per comp. welding procedure (Doc. No. LGTPR-8121-2041)			F.S. No.	-
Proc.No.	LGTPR-8121-2005 (Main turb. Inspection & Test proc.)			Acceptance criteria	ASME Sec.VIII Div.1 App. 6
Equipment	☒ A-6 (Eishin-Kagaku) ☐ ES-1S (Eishin-Kagaku)			Method	☐ Residual method ☒ Continuous method
Current	☒ AC ÷ A ☐ DC 3600 AT			Reference piece	ASTM field indicator
				Prod distance	- mm
Magnetized time	2 sec. 2 times			Surface condition	Sand blast
Magnetizing method	☐ Prod	☐ Coil	☒ Yoke	☐ Direct	☐ Through conductor
Powder	☒ Wet method ☐ Dry method	☐ Black	☐ White	☐ Brown	☒ Fluorescence
Powder type	Wet	☒ SY-8000 (Eishin-kagaku)			
	Dry	☐ Magnatron MA-100 (Red)	☐ Magnatron (White) (Eishin-kagaku)		

■ Other information

Location : Welding joints.

Stage of inspection : After PWHT.

Lifting power : 10 ft-lb (4.5Kgf) / Only for yoke method.

■ Result

☒ Acceptable ☐ Not acceptable

■ Examiner / Certified No.

Y. ISHIWATA / 57817

■ Note Reference item number of quality plan : D03

TO	SET

	Approved (QA dept.)	Checked (QA dept.)	Prepared	Customer / Inspector
by				INSPECTION TEAM ☐WITNESSED ☒REVIEWED
Date	Apr. 16 '03	Apr.-16-2003	APR. 16. '03	LG E&C Aug. 6, '03

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

P

SUBJECT	STEAM TURBINE / LIQUID PENETRANT EXAMINATION RECORD				
EBARA SER. No.	R021570803	MODEL	SRV-5DF	ITEM No.	CT-9901
MACH. No.					

Part Name	Exhaust end casing
Part No.	-
Quantity	1

■ Table : Condition

Joint No.	As per comp. welding procedure (Doc. No. LGTPR-8121-2041)	F.S. No.	-
Proc.No.	LGTPR-8121-2005 (Main turb. Inspection & Test proc.)	Acceptance criteria	ASME Sec.VIII Div.1 App. 8
Penetrant	R-1A (NT) / Eishin-Kagaku	Penetration time	15 Minutes
Developer	R-1S (NT) / Eishin-Kagaku	Temperature	18 ℃
Solvent	R-1M (NT) / eishin-Kagaku	Surface condition	Sand blast

■ Other information

Location : Weld joints.

Stage of inspection : After PWHT.

■ Result

☒ Acceptable ☐ Not acceptable

■ Examiner / Certified No.

Y. ISHIWATA / 57817

■ Note Reference item number of quality plan : D03

TO	SET

	Approved (QA dept.)	Checked (QA dept.)	Prepared	Customer / Inspector
by				INSPECTION TEAM ☐WITNESSED ☒REVIEWED
Date	Apr-16'03	Apr.-16-2003	APR-16.'03	H.G E&C Aug. 6, '03

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

SUBJECT	STEAM TURBINE CASING / HYDROSTATIC PRESSURE TEST RECORD				
EBARA SER. No.	R021570803	MODEL	SRV-5DF	ITEM No.	CT-9901
MACHINE No.	–				

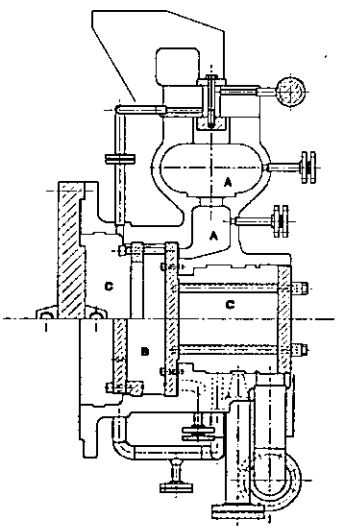
■ Acceptance criteria : No visible leakage during holding time of Min. 30 Minutes.

■ Condition : Using potable water.

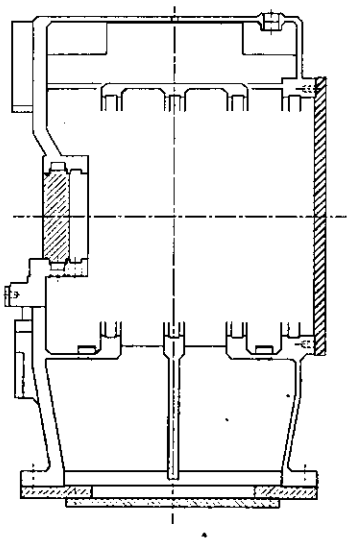
■ Table : Hydrostatic test water pressure of each portion of casing.

No.	Parts Name		Test pressure kgf/cm2G (Mpa G)	Result	Gage No.
1	Steam chest	☑ Steam chest : A	86.0 (8.43)	☑ Acceptable ☐ Not acceptable	15-6 (447819) 15-8 (447821)
2	Steam end casing	☑ Before nozzle : A	86.0 (8.43)	☑ Acceptable ☐ Not acceptable	15-6 (447819) 15-8 (447821)
3		☐ After nozzle : B	17.0 (1.67)	☐ Acceptable ☐ Not acceptable	
4		☐ After nozzle : C	6.0 (0.59)	☐ Acceptable ☐ Not acceptable	
5		☐ After nozzle:		☐ Acceptable ☐ Not acceptable	
6	Exhaust end casing	☑ Exhaust end casing	1.5 (0.15)	☑ Acceptable ☐ Not acceptable	0.3-2 (4191670) 0.3-3 (4678761)

■ Figure :



Steam end casing



Exhaust end casing

■ Note Reference item number of quality plan : D07

TO	SET

Approved (QA dept.)	Checked (QA dept.)	Prepared	Customer / Inspector
by Jul. 25 '03	July-25-2003	Y. Saito 7-25-2003	INSPECTION TEAM ☐WITNESSED ☒REVIEWED Y. Tsutsumi Aug 6 '03
Date			

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

Inspection Activity 41

Subvendor	Ebara	Customer

P

SUBJECT	STEAM TURBINE CASING / HYDROSTATIC PRESSURE TEST RECORD				
EBARA SER. No.	R021570803	MODEL	SRV-5DF	ITEM No.	CT-9901
MACHINE No.	-				

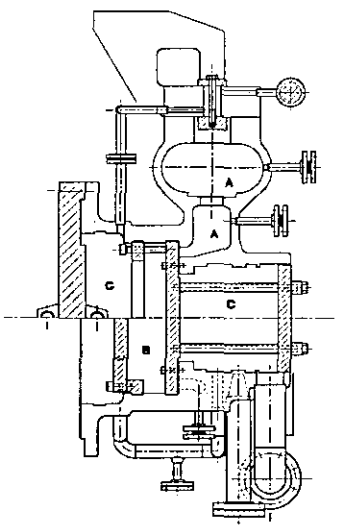
■ Acceptance criteria : No visible leakage during holding time of Min. 30 Minutes.

■ Condition : Using potable water.

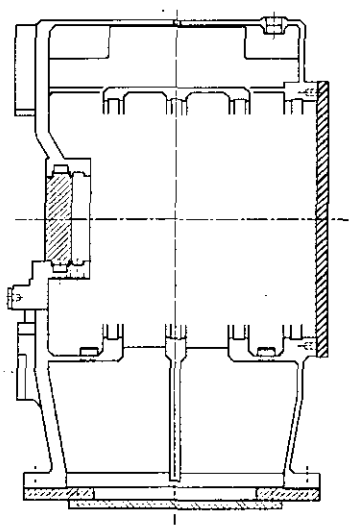
■ Table : Hydrostatic test water pressure of each portion of casing.

No.	Parts Name		Test pressure kgf/cm2G (Mpa G)	Result	Gage No.
1	Steam chest	☐ Steam chest : A	86.0 (8.43)	☐ Acceptable ☐ Not acceptable	
2	Steam end casing	☐ Before nozzle : A	86.0 (8.43)	☐ Acceptable ☐ Not acceptable	
3		☒ After nozzle : B	17.0 (1.67)	☒ Acceptable ☐ Not acceptable	JB11856 3.5-4 JL01839 3.5-2
4		☒ After nozzle : C	6.0 (0.59)	☒ Acceptable ☐ Not acceptable	AA01485 1-6 IL19799 F-1
5		☐ After nozzle:		☐ Acceptable ☐ Not acceptable	
6	Exhaust end casing	☐ Exhaust end casing	1.5 (0.15)	☐ Acceptable ☐ Not acceptable	

■ Figure :



Steam end casing



Exhaust end casing

■ Note Reference item number of quality plan : D07

TO	SET

Approved (QA dept.)	Checked (QA dept.)	Prepared	Customer / Inspector
by Date Aug 11, '03	—	Y. Saito 8-11-2003	INSPECTION TEAM ☒WITNESSED ☐REVIEWED LG E&C K. Tsutsumi Aug 11, '03

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

P

SUBJECT	STEAM TURBINE ROTOR / HIGH SPEED BALANCE RECORD		
EBARA SER. No.	R021570803	MODEL SRV-5DF	ITEM No. CT-9901
MACH. No. –	ROTOR I.D. B		

■ Condition :

Type of balancing machine ■ Schenk DH4 □ Schenk DH7

Rotor weight 1000 kgf

Test speeds are showm below. Holding time at overspeed is Min. 3 min.

Correction method □ Removed ■ Added

■ Table : Measured shaft vibration amplitude data.

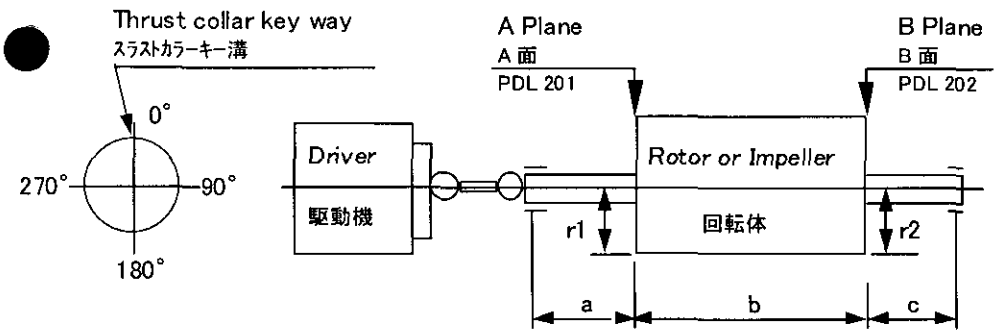
Shaft vibration amplitude		A Plane (PDL 201)		B Plane (PDL 202)		Criteria	Result
Test speed	min-1	X μm p-p	Y μm p-p	X μm p-p	Y μm p-p	μm p-p	
Maximum continuous speed	10828	6.9	7.5	3.5	5.0	25.0	ACCEPTABLE
Trip speed	11911	9.9	10.4	3.7	7.1	*	ACCEPTABLE

* : As per API

■ Table : Residual unbalance (Reference only data)

Low speed balance	A Plane (Drive end) (PDL 201)				B Plane (Free end) (PDL 202)			
Test speed 1850 min-1	Phase °	Weight g	r 1 mm	Amount g-mm	Phase °	Weight g	r 2 mm	Amount g-mm
Initial unbalance	358	13.8	176.4	2434.3	357	37	176.4	6526.8
Final unbalance	52	2.53	176.4	446.3	86	4.26	176.4	751.5

■ Figure: Typical sketches



Thrust collar is

□ A plane side

■ B plane side

Unit : mm

a	515
b	920
c	660
r1	176.4
r2	176.4

Zero phase angle is relative to _____

Reading of phase angle is (■ CW, □ CCW) viewing from (□ thrust, ■ non-thrust) end side.

■ Note Reference item number of quality plan : E04

	Approved (Aero equip. eng. dept.)	Checked (Aero equip. eng. dept.)	Prepared (Aero equip. eng. dept.)	Customer / Inspector
by	H. Ishikawa	—	H. Ishikawa	INSPECTION TEAM ☒WITNESSED ☐REVIEWED LG E&C K. Tsutsumi Aug. 26. '03
Date	Aug. 26th '03		Aug. 26th '03	

TO	SET

EBARA Corp.

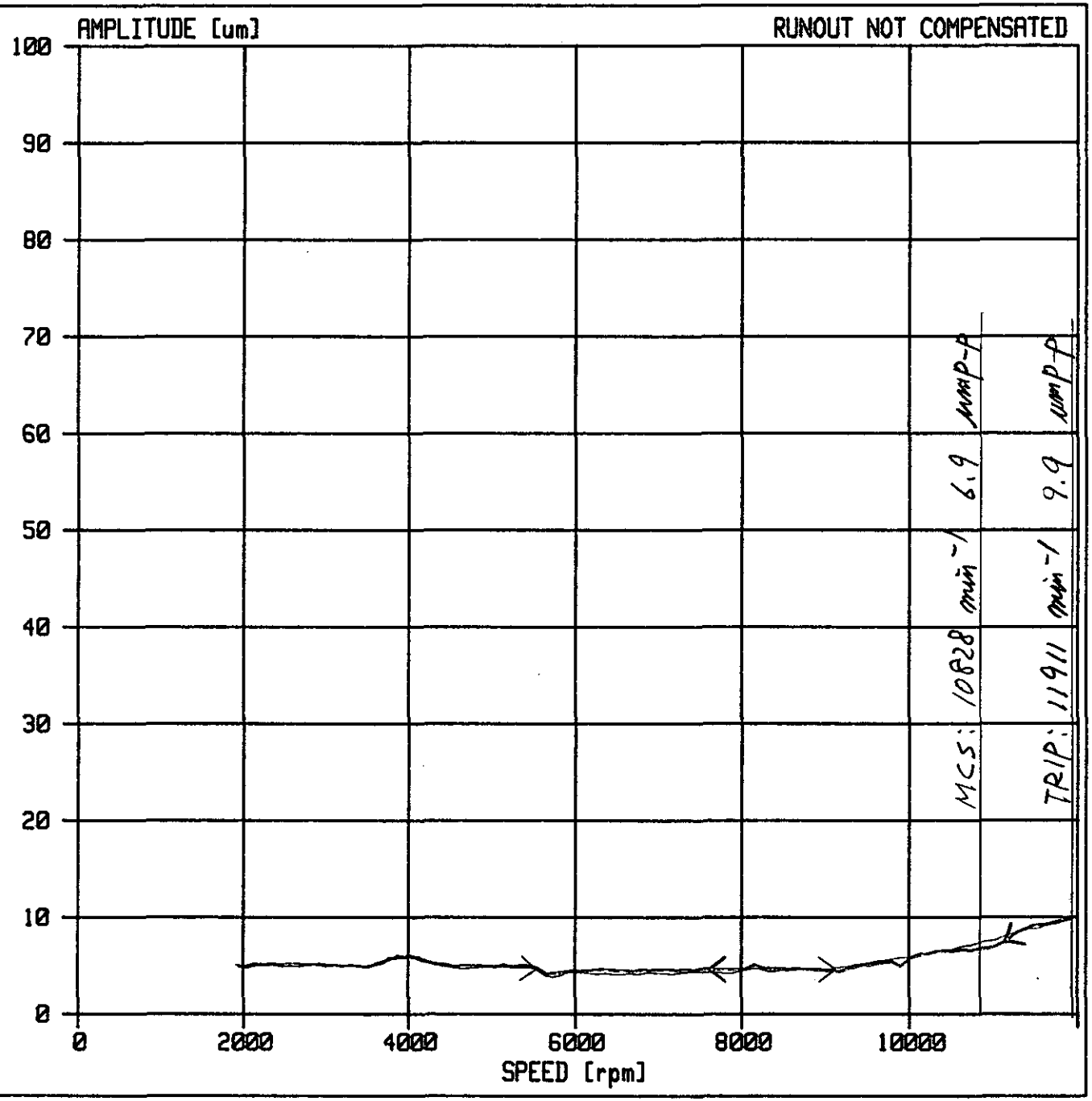
R021570836

26-08-103 09:45

ACCEL. DECEL.

ROTOR ID.:
JSRV-5DF B rotor

RUN NO.: 13
WITNESS RUN
DEVICE: VC 2000
CHANNEL: 1
PICK UP:
SV
CPLG END PDL201 X



INSPECTION TEAM
☒WITNESSED ☐REVIEWED
LG E&C
J. Tsutsumi
Aug. 26. '08

EBARA Corp.

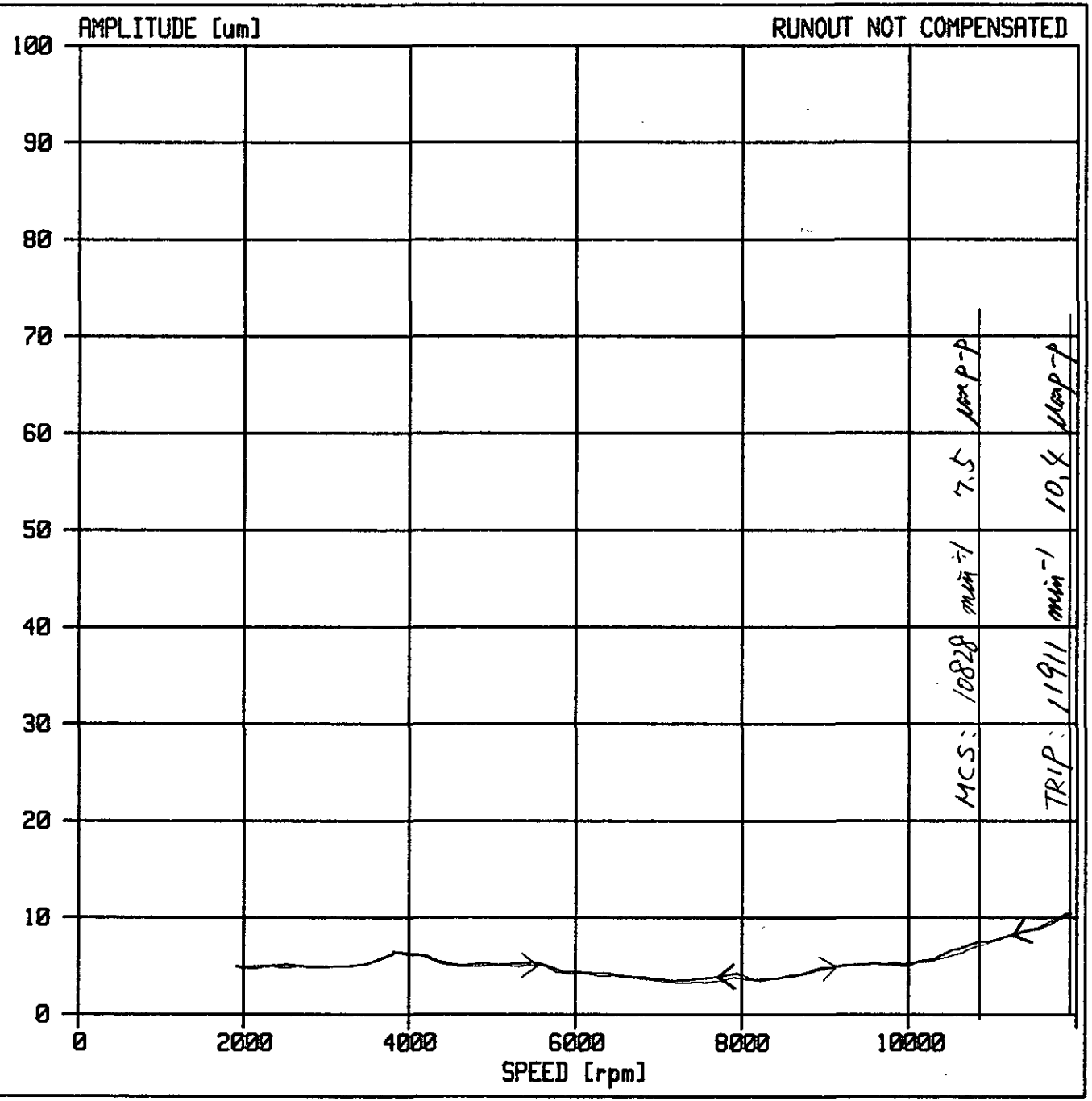
R021570836

26-08-103 09:45

ACCEL. DECEL.

ROTOR ID.:
JSRV-5DF B rotor

RUN NO.: 13
WITNESS RUN
DEVICE: VC 2000
CHANNEL: 2
PICK UP:
SV
CPLG END PDL201 Y



INSPECTION TEAM
☒WITNESSED ☐REVIEWED
LG E&C
Aug. 26. '03

EBARA Corp.

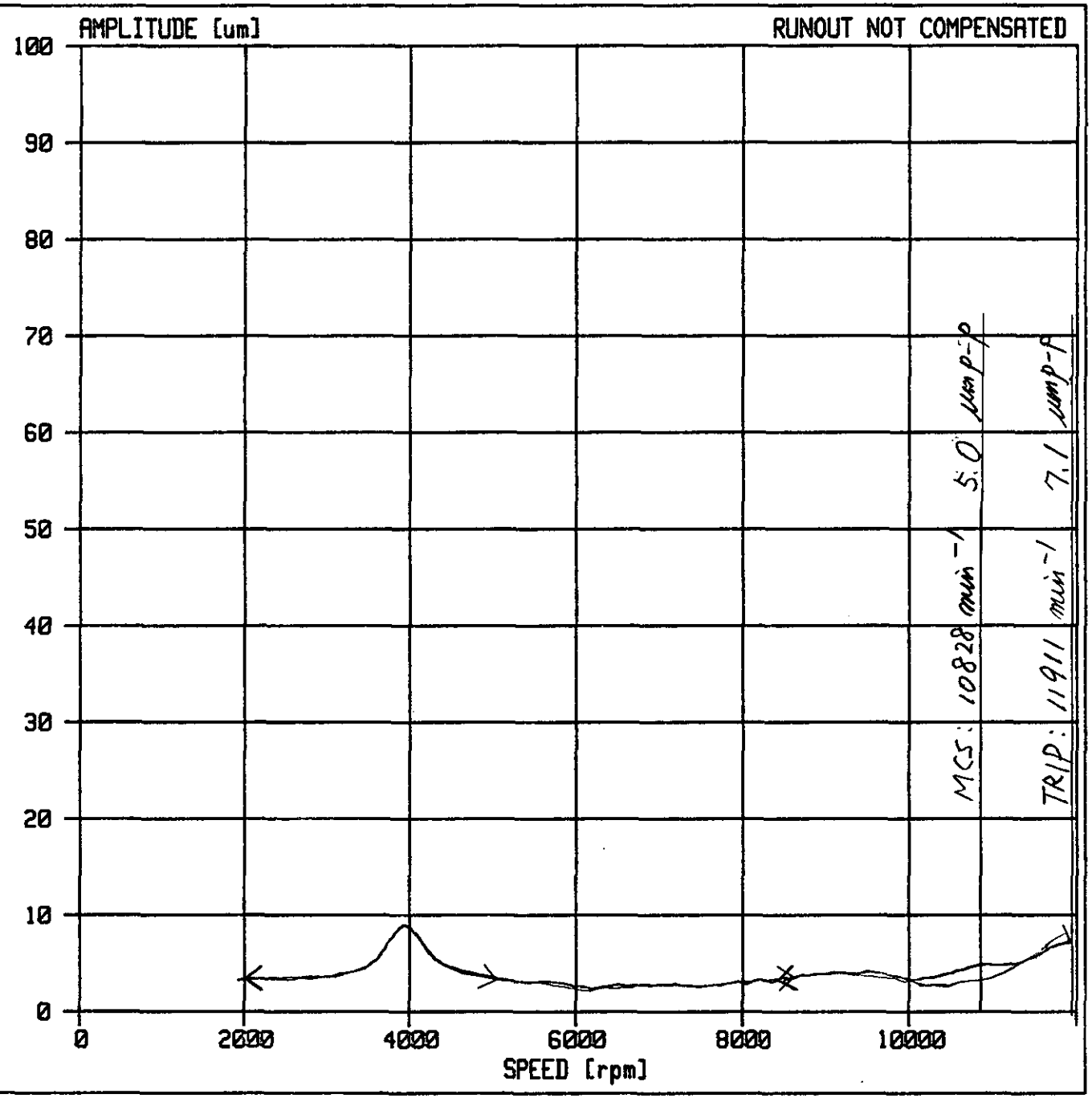
R02157083G

26-08-103 09:45

ACCEL. DECEL.

ROTOR ID.:
JSRV-5DF B rotor

RUN NO.: 13
WITNESS RUN
DEVICE: VC 2000
CHANNEL: 7
PICK UP:
SV
FREE END PDL202 X



INSPECTION TEAM
☒WITNESSED ☐REVIEWED
LG E&C
Aug. 26, '03

EBARA Corp.

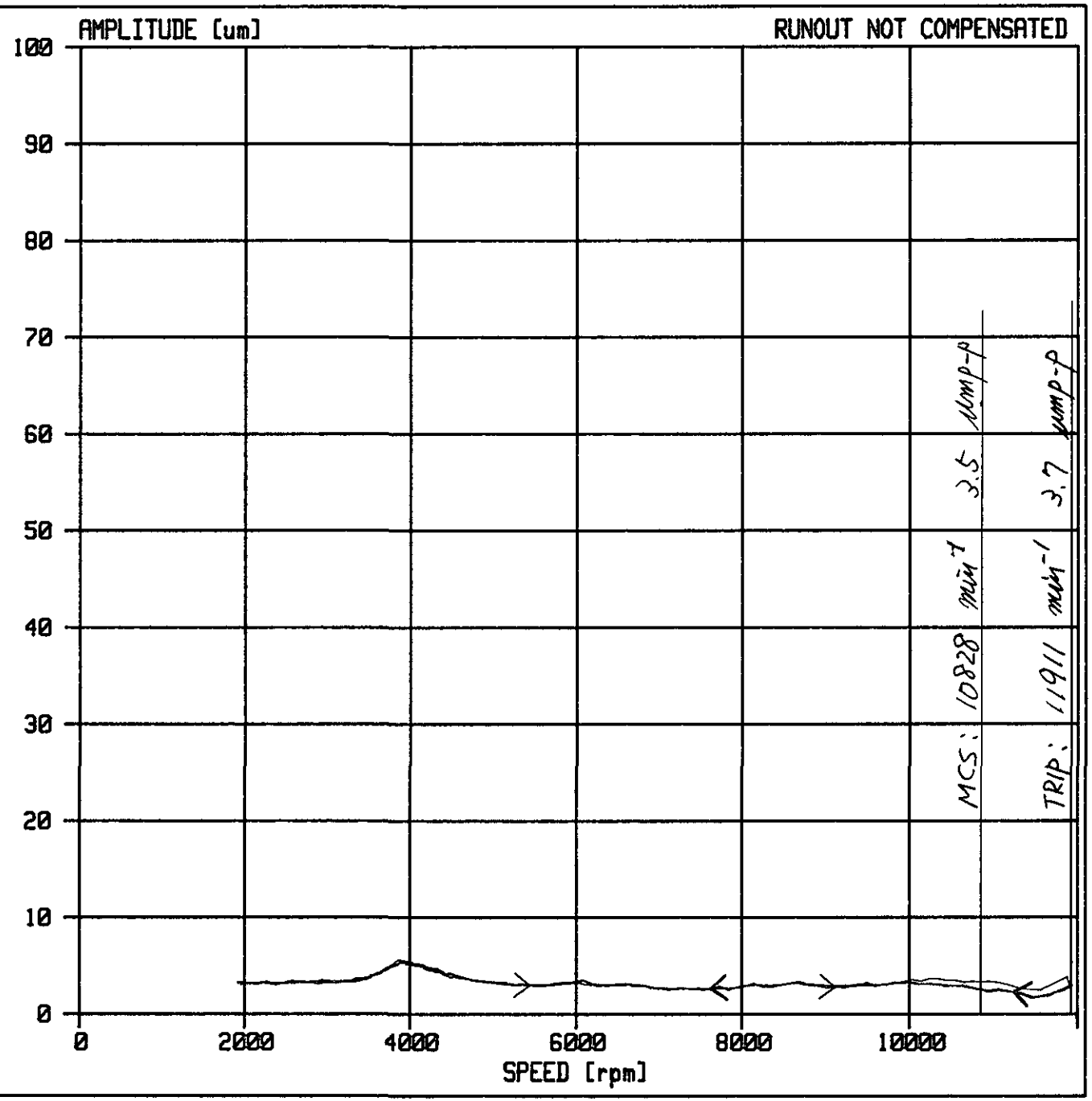
R02157083G

26-08-103 09:45

ACCEL. DECEL.

ROTOR ID.:
JSRV-5DF B rotor

RUN NO.: 13
WITNESS RUN
DEVICE: VC 2000
CHANNEL: 8
PICK UP:
SV
FREE END PDL202 Y

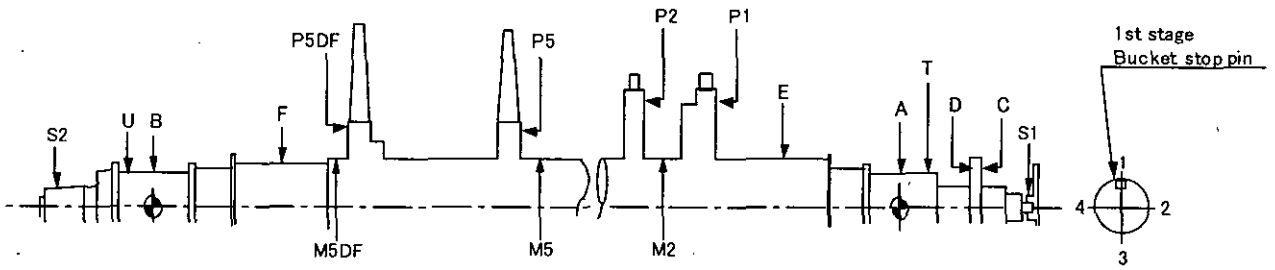


LG E&C	INSPECTION TEAM ☒WITNESSED ☐REVIEWED J. Tsutsumi Aug. 26. '03

P

SUBJECT	STEAM TURBINE ROTOR / MECHANICAL RUNOUT TEST RECORD		
EBARA SER. No.	R021570803	MODEL SRV-5DF	ITEM No. CT-9901
MACH. No. –	ROTOR I.D. B		

■ Figure : Typical sketches of compressor rotor



■ Table : Measured data.

Unit : mm

	Location	Allowance	Point 1	Point 2	Point 3	Point 4	Runout	Result
A	Journal Bearing	0.0127	0	0	0.002	0	0.002	Acceptable
B	Journal Bearing	0.0127	0	0.003	0.001	0.001	0.003	
C	Thrust Face	0.0127	0	0.003	0.002	0.001	0.003	
D	Thrust Face	0.0127	0	0.001	0.002	0.002	0.002	
E	Shaft seal surfase	0.025	0	0.002	0.002	0.004	0.004	
F	Shaft seal surfase	0.025	0	0.005	0.003	0.004	0.005	↓
M2	Shaft seal surfase	0.025	0	0.007	0.001	-0.004	0.011	Acceptable
M3	Shaft seal surfase	0.025	0	0.005	0.006	0.001	0.006	
M4	Shaft seal surfase	0.025	0	0.002	0.002	0	0.002	
M5	Shaft seal surfase	0.025	0	0.005	0.003	-0.002	0.007	
M5DF	Shaft seal surfase	0.025	0	0.002	0	-0.002	0.004	↓
P1	Disk fase	0.25	0	-0.001	-0.001	0	0.001	Acceptable
P2	Disk fase	0.25	0	-0.002	-0.002	-0.003	0.003	
P3	Disk fase	0.25	0	0.001	0.001	0	0.001	
P4	Disk fase	0.25	0	0.001	0.004	-0.007	0.011	
P5	Disk fase	0.25	0	-0.004	0.001	0.001	0.005	
P5DF	Disk fase	0.25	0	0	0.001	-0.002	0.003	↓
S1	Shaft	0.025	0	0.006	0.016	0.017	0.017	Acceptable
S2	Shaft	0.025	0	0	0.003	0.005	0.005	
T	Vibration Sensing Area	0.005	0	0	0.001	0.001	0.001	
U	Vibration Sensing Area	0.005	0	0.002	0	0.001	0.002	↓

■ Note Reference item number of quality plan : E08

TO	SET

	Approved (QA dept.)	Checked (QA dept.)	Prepared	Customer / Inspector
by			T. KAZUMA	INSPECTION TEAM ☐WITNESSED ☒REVIEWED
Date	AUG. 5 '03	Aug.-5-2003	AUG. 04 '03	LQ E&C Aug 26,'03

ELLIOTT EBARA GROUP

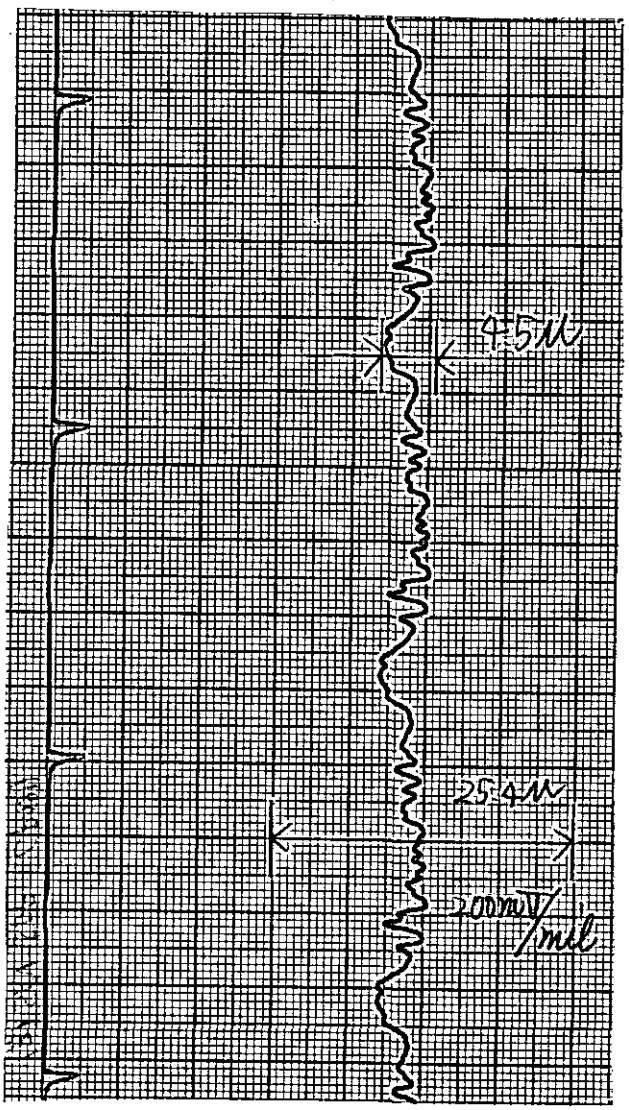
Elliott Ebara Turbomachinery Corporation

P

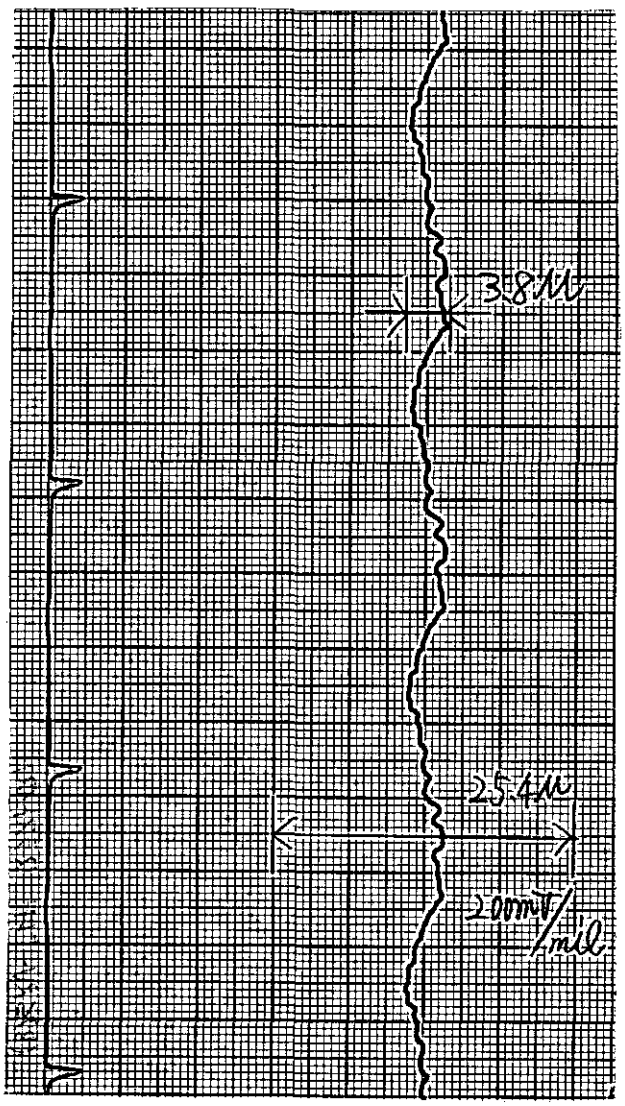
SUBJECT	STEAM TURBINE ROTOR / TOTAL (MECHANICAL & ELECTRICAL) RUN-OUT RECORD (RADIAL)		
EBARA SER. No.	R021570803	MODEL SRV-5DF	ITEM No. CT-9901
MACH. No. –	ROTOR I.D. B		

Vibration probe sensing area

Location ☐ Thrust side ☑ Non thrust side
Criteria Max. 6.4 μm
Result ☑ Acceptable ☐ Not acceptable



Location ☑ Thrust side ☐ Non thrust side
Criteria Max. 6.4 μm
Result ☑ Acceptable ☐ Not acceptable



■ Note Reference item number of quality plan : E09

TO	SET

	Approved (QA dept.)	Checked (QA dept.)	Prepared	Customer / Inspector
by			T. KAZUMA	INSPECTION TEAM ☐WITNESSED ☒REVIEWED
Date	Aug. 5 '03	Aug. 5 2003	AUG 04 '03	LG E&C Aug. 26 '03

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

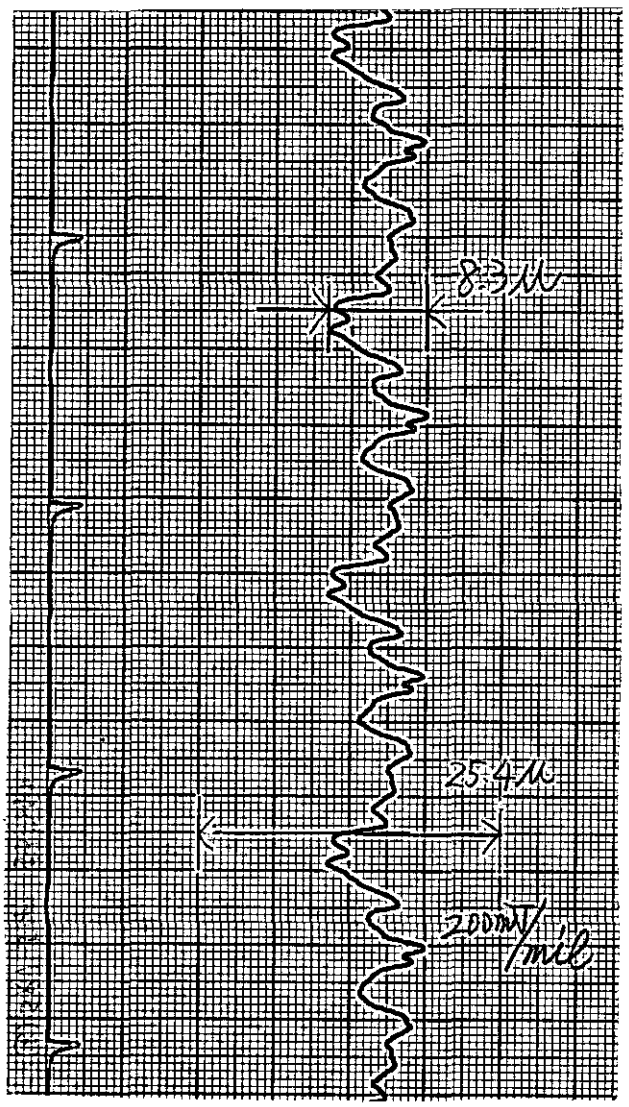
P

SUBJECT	STEAM TURBINE ROTOR / TOTAL (MECHANICAL & ELECTRICAL) RUN-OUT RECORD (AXIAL)		
EBARA SER. No.	R021570803	MODEL SRV-5DF	ITEM No. CT-9901
MACH. No. –	ROTOR I.D. B		

Axial probe sensing area

Location ☐ Thrust nut
☐ Shaft end
Criteria Max. 12.7 μm
Result ☐ Acceptable
☐ Not acceptable

Location ☐ Thrust nut
☒ Shaft end
Criteria Max. 12.7 μm
Result ☑ Acceptable
☐ Not acceptable



■ Note Reference item number of quality plan : E09

TO	SET

	Approved (QA dept.)	Checked (QA dept.)	Prepared	Customer / Inspector
by			T.KAZUMA	INSPECTION TEAM ☐WITNESSED ☒REVIEWED
Date	AUG. 5 '03	Aug.-5-2003	AUG 04 '03	LG E&C Aug 26, '03

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

Inspection Activity

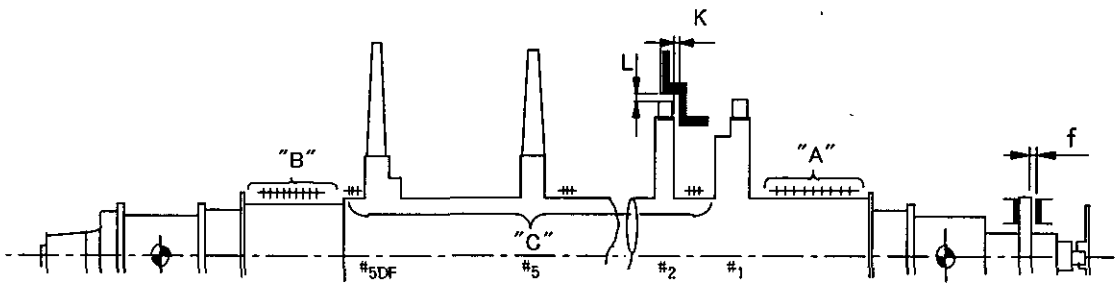
Subvendor	Ebara	Customer

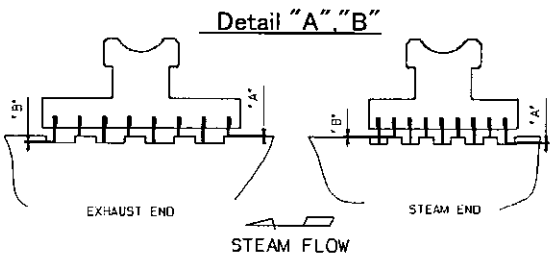
QAR-TU-J01

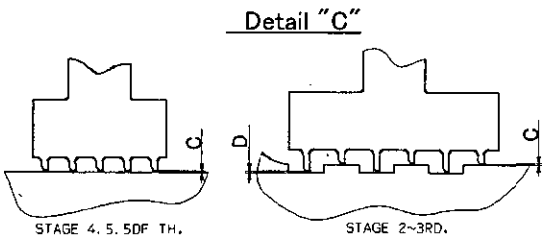
P

SUBJECT	STEAM TURBINE ROTOR / CLEARANCE RECORD (1/2)		
EBARA SER. No. R021570803	MODEL SRV-5DF	ITEM No. CT-9901	
MACH. No. –	ROTOR I.D. B		

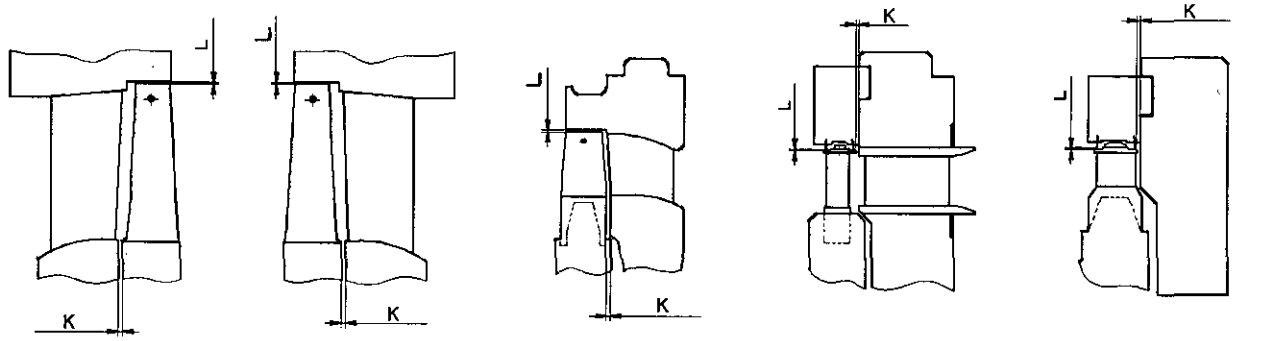
■ Condition : All clearances are shown as radial clearance.







DIAFRAM SEAL CLEARANCE



5DF.TH STAGE CLEARANCE | 5TH STAGE CLEARANCE | 4TH STAGE CLEARANCE | 2ND.,3RD STAGE CLEARANCE | 1ST STAGE CLEARANCE

DIAFRAM CLEARANCES

■ Note Reference item number of quality plan : J01

TO	SET

	Approved (QA dept.)	Checked (QA dept.)	Prepared	Customer / Inspector
by			K. Yoshida	INSPECTION TEAM ☐WITNESSED ☑REVIEWED
Date	Oct. 14 '03	Oct.-14-2003	Oct. 7. 2003	Oct. 15, 2003

LG E&C

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

Inspection Activity 51

Subvendor	Ebara	Customer

QAR-CO-J01

P

SUBJECT	STEAM TURBINE / CLEARANCE RECORD (2/2)		
EBARA SER. No. R021570803	MODEL SRV-5DF	ITEM No. CT-9901	
MACH. No. –	ROTOR I.D. B		

■ Table : Measured data. Unit: mm

Location		Result	Dwg min.	Dwg max.	Actual data			
Packing clearance (steam end)	A	Acceptable	0.39	0.47	L	0.40 ~0.46	R	0.40 ~0.46
Packing clearance (steam end)	B	↑	0.39	0.47	L	0.40 ~0.46	R	0.40 ~0.46
Packing clearance (exh. end)	A	↓	0.39	0.47	L	0.42 ~0.47	R	0.41 ~0.47
Packing clearance (exh. end)	B	Acceptable	0.39	0.47	L	0.42 ~0.47	R	0.41 ~0.47
Diaphragm seal (2nd. stage)	C	Acceptable	0.39	0.47	L	0.42~0.45	R	0.42~0.45
Diaphragm seal (2nd. stage)	D	↑	0.39	0.47	L	0.42~0.45	R	0.42~0.45
Diaphragm seal (3rd. stage)	C	↓	0.39	0.47	L	0.42~0.44	R	0.42~0.43
Diaphragm seal (3rd. stage)	D		0.39	0.47	L	0.42~0.44	R	0.42~0.43
Diaphragm seal (4th. stage)	C	Acceptable	0.39	0.47	L	0.43~0.44	R	0.43~0.45
–	–	–	–	–	–	–	–	–
Diaphragm seal (5th. stage)	C	Acceptable	0.39	0.47	L	0.42~0.44	R	0.42~0.44
–	–	–	–	–	–	–	–	–
Diaphragm seal (5DF th. stage)	C	Acceptable	0.39	0.47	L	0.42~0.43	R	0.42~0.43
–	–	–	–	–	–	–	–	–
Nozzle ring & diaphragm (1st.stage)	K	Acceptable	1.44	1.70	L	1.59	R	1.58
Nozzle ring & diaphragm (1st.stage)	L	↑	0.63	0.96	L	0.70~0.74	R	0.70~0.74
Nozzle ring & diaphragm (2nd.stage)	K		1.35	2.11	L	1.65	R	1.69
Nozzle ring & diaphragm (2nd.stage)	L		0.63	0.96	L	0.65	R	0.63~0.65
Nozzle ring & diaphragm (3rd.stage)	K		1.35	2.11	L	1.63	R	1.85
Nozzle ring & diaphragm (3rd.stage)	L		0.63	0.96	L	0.63	R	0.64~0.65
Nozzle ring & diaphragm (4th.stage)	K		6.10	6.86	L	6.50	R	6.44
Nozzle ring & diaphragm (4th.stage)	L		1.47	1.72	L	1.47	R	1.47
Nozzle ring & diaphragm (5th.stage)	K		2.93	3.69	L	3.24	R	3.18
Nozzle ring & diaphragm (5th.stage)	L		1.47	1.72	L	1.50	R	1.56
Nozzle ring & diaphragm (5DF th.stag	K	↓	2.93	3.69	L	3.11	R	3.03
Nozzle ring & diaphragm (5DF th.stag	L	Acceptable	1.47	1.72	L	1.53	R	1.50
Rotor float	f	Acceptable	0.23	0.30	–	0.26	–	

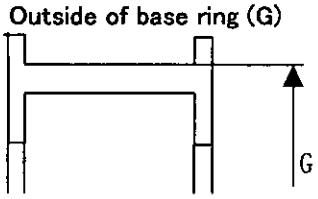
LG E&C INSPECTION TEAM ☐WITNESSED ☑REVIEWED Oct. 15, 2002

■ Note Reference item number of quality plan : J01

SUBJECT	STEAM TURBINE / BEARING CLEARANCE RECORD		
EBARA SER. No.	R021570803	MODEL SRV-5DF	ITEM No. CT-9901
MACH. No.	ROTOR I.D. B		

Steam end side

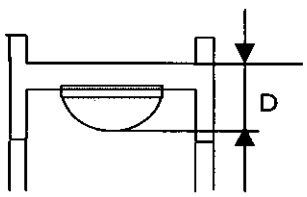
1. Outside of base ring (G)



Unit : mm

Design	158.725 $^{0}_{-0.013}$
Actual φG	158.718

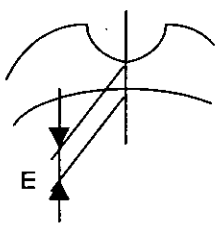
3. Base ring & bearing sheet hight (D)



Unit : mm

Design	10.008 $^{0}_{-0.006}$					
Actual D	10.003	10.006	10.003	10.003	10.004	
D	Ave.	10.004				

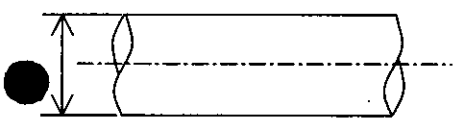
4. Bearing pad thickness



Unit : mm

Design	5.817 $^{0}_{-0.006}$					
Actual E	5.814	5.814	5.815	5.813	5.815	
E	Ave.	5.814				

4. Outside dia of shaft



Unit : mm

Design	126.873 $^{0}_{-0.013}$
Actual φF	126.870

5. Bearing clearance

Unit : mm

Design	0.191 ~ 0.242
Actual	0.212

Exhaust end side

Unit : mm

Design	158.725 $^{0}_{-0.013}$
Actual φG	158.718

Unit : mm

Design	10.008 $^{0}_{-0.006}$					
Actual D	10.004	10.003	10.007	10.007	10.006	
D	Ave.	10.005				

Unit : mm

Design	5.817 $^{0}_{-0.006}$					
Actual E	5.813	5.813	5.813	5.814	5.812	
E	Ave.	5.813				

Unit : mm

Design	126.937 $^{0}_{-0.013}$
Actual φF	126.935

Unit : mm

Design	0.127 ~ 0.178
Actual	0.147

(a) : Bearing clearance = φG−2(D+E)−φF

■ Note : Reference item number of quality plan : J01A

TO	SET

Aproved (QA dept.)	Checked (QA dept.)	Prepared	Customer / Inspector
by	—		INSPECTION TEAM ☐WITNESSED ☑REVIEWED
Date Oct. 11, '03		Aug.-11-2003	Oct. 15, 2003

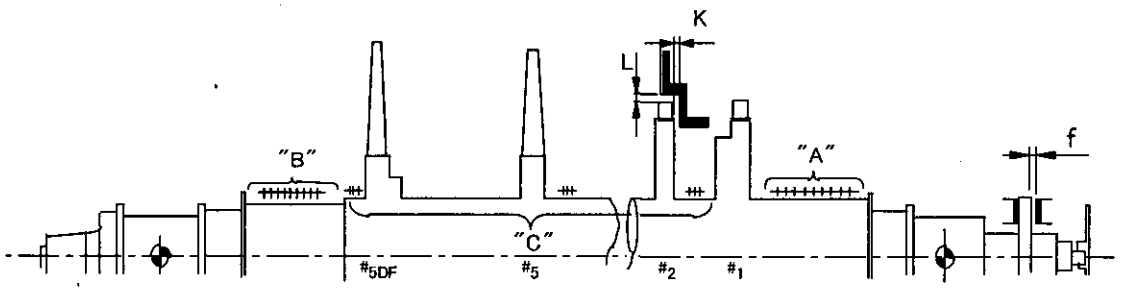
LG E&C

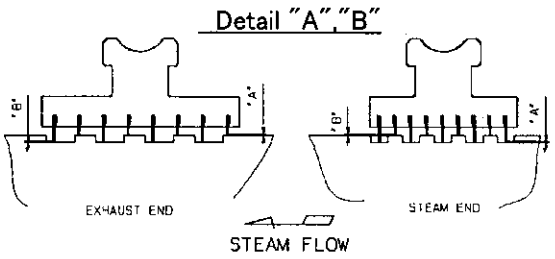
ELLIOTT EBARA GROUP

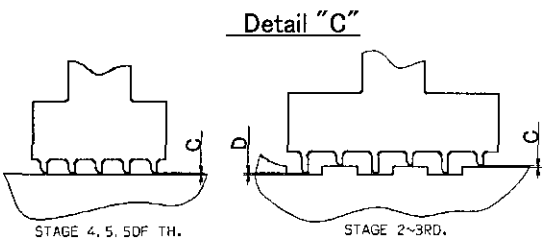
Elliott Ebara Turbomachinery Corporation

SUBJECT	STEAM TURBINE ROTOR / CLEARANCE RECORD (1/2)		
EBARA SER. No.	R021570803	MODEL SRV-5DF	ITEM No. CT-9901
MACH. No. –	ROTOR I.D. A		

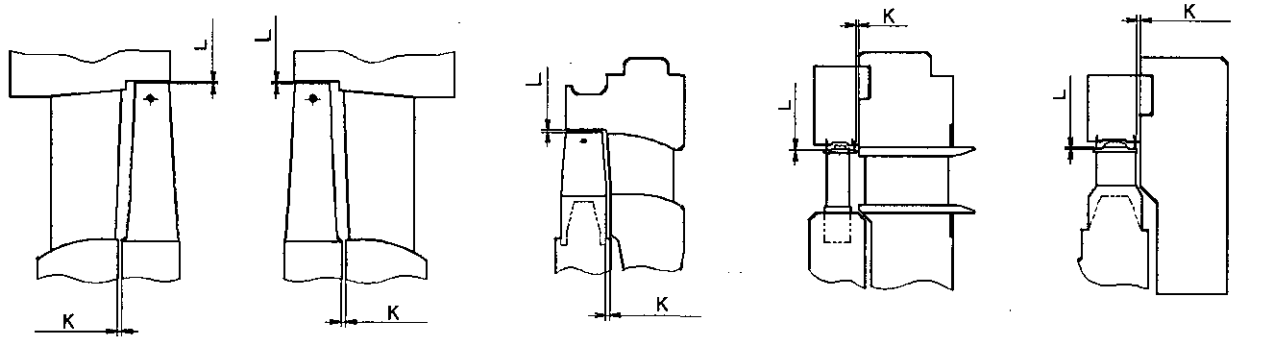
■ Condition : All clearances are shown as radial clearance.







DIAFRAM SEAL CLEARANCE



5DF.TH STAGE CLEARANCE 5TH STAGE CLEARANCE 4TH STAGE CLEARANCE 2ND., 3RD STAGE CLEARANCE 1ST STAGE CLEARANCE

DIAFRAM CLEARANCES

■ Note Reference item number of quality plan : J01

TO	SET

	Approved (QA dept.)	Checked (QA dept.)	Prepared	Customer / Inspector
by			K. Yoshida	INSPECTION TEAM ☐WITNESSED ☑REVIEWED
Date	Sep-17'2003	Sep.-17-2003	Sep. 2. 2003	Oct. 15. 2003

LG E&C

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

Inspection Activity

Subvendor	Ebara	Customer

QAR-CO-J01

P

SUBJECT	STEAM TURBINE / CLEARANCE RECORD (2/2)		
EBARA SER. No. R021570803	MODEL SRV-5DF	ITEM No. CT-9901	
MACH. No. –	ROTOR I.D. A		

■ Table : Measured data. Unit: mm

Location		Result	Dwg min.	Dwg max.	Actual data			
Packing clearance (steam end)	A	Acceptable	0.39	0.47	L	0.40 ~0.44	R	0.40 ~0.45
Packing clearance (steam end)	B		0.39	0.47	L	0.40 ~0.44	R	0.40 ~0.45
Packing clearance (exh. end)	A		0.39	0.47	L	0.40 ~0.45	R	0.43 ~0.45
Packing clearance (exh. end)	B	Acceptable	0.39	0.47	L	0.40 ~0.45	R	0.43 ~0.45
Diaphragm seal (2nd. stage)	C	Acceptable	0.39	0.47	L	0.41	R	0.39
Diaphragm seal (2nd. stage)	D		0.39	0.47	L	0.41	R	0.39
Diaphragm seal (3rd. stage)	C		0.39	0.47	L	0.42	R	0.39
Diaphragm seal (3rd. stage)	D		0.39	0.47	L	0.42	R	0.39
Diaphragm seal (4th. stage)	C	Acceptable	0.39	0.47	L	0.42	R	0.39
–	–	–	–	–	–	–	–	–
Diaphragm seal (5th. stage)	C	Acceptable	0.39	0.47	L	0.40	R	0.39
–	–	–	–	–	–	–	–	–
Diaphragm seal (5DF th. stage)	C	Acceptable	0.39	0.47	L	0.39	R	0.40
–	–	–	–	–	–	–	–	–
Nozzle ring & diaphragm (1st.stage)	K	Acceptable	1.44	1.70	L	1.59	R	1.58
Nozzle ring & diaphragm (1st.stage)	L		0.63	0.96	L	0.65	R	0.63
Nozzle ring & diaphragm (2nd.stage)	K		1.35	2.11	L	1.65	R	1.69
Nozzle ring & diaphragm (2nd.stage)	L		0.63	0.96	L	0.70	R	0.65
Nozzle ring & diaphragm (3rd.stage)	K		1.35	2.11	L	1.63	R	1.85
Nozzle ring & diaphragm (3rd.stage)	L		0.63	0.96	L	0.69	R	0.66
Nozzle ring & diaphragm (4th.stage)	K		6.10	6.86	L	6.50	R	6.44
Nozzle ring & diaphragm (4th.stage)	L		1.47	1.72	L	1.47	R	1.50
Nozzle ring & diaphragm (5th.stage)	K		2.93	3.69	L	3.24	R	3.18
Nozzle ring & diaphragm (5th.stage)	L		1.47	1.72	L	1.50	R	1.48
Nozzle ring & diaphragm (5DF th.stag	K		2.93	3.69	L	3.11	R	3.03
Nozzle ring & diaphragm (5DF th.stag	L	Acceptable	1.47	1.72	L	1.48	R	1.48
Rotor float	f	Acceptable	0.23	0.30	–	0.26	–	

LG E&C

INSPECTION TEAM
☐WITNESSED ☑REVIEWED
Oct. 15, 2003

■ Note Reference item number of quality plan : J01

Inspection Activity		
Subvendor	Ebara	Customer

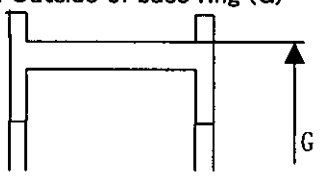
QAR-CO-J01A

P

SUBJECT	STEAM TURBINE / BEARING CLEARANCE RECORD		
EBARA SER. No.	R021570803	MODEL SRV-5DF	ITEM No. CT-9901
MACH. No.	ROTOR I.D. A		

Steam end side

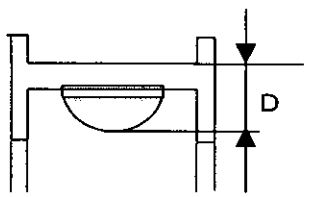
1. Outside of base ring (G)



Unit : mm

Design	158.725 $^{0}_{-0.013}$
Actual φG	158.718

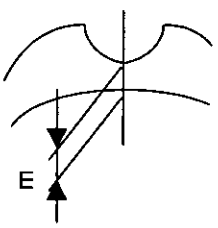
3. Base ring & bearing sheet hight (D)



Unit : mm

Design	10.008 $^{0}_{-0.006}$					
Actual D	10.003	10.006	10.003	10.003	10.004	
D	Ave.	10.004				

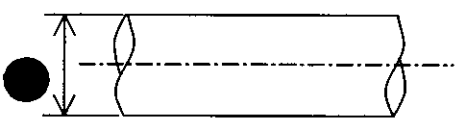
4. Bearing pad thickness



Unit : mm

Design	5.817 $^{0}_{-0.006}$					
Actual E	5.814	5.814	5.815	5.813	5.815	
E	Ave.	5.814				

4. Outside dia of shaft



Unit : mm

Design	126.873 $^{0}_{-0.013}$
Actual φF	126.870

5. Bearing clearance

Unit : mm

Design	0.191 ~ 0.242
Actual	0.212

Exhaust end side

Unit : mm

Design	158.725 $^{0}_{-0.013}$
Actual φG	158.718

Unit : mm

Design	10.008 $^{0}_{-0.006}$					
Actual D	10.004	10.003	10.007	10.007	10.006	
D	Ave.	10.005				

Unit : mm

Design	5.817 $^{0}_{-0.006}$					
Actual E	5.813	5.813	5.813	5.814	5.812	
E	Ave.	5.813				

Unit : mm

Design	126.937 $^{0}_{-0.013}$
Actual φF	126.925

Unit : mm

Design	0.127 ~ 0.178
Actual	0.157

(a) : Bearing clearance = φG−2(D+E)−φF

■ Note : Reference item number of quality plan : J01A

TO	SET

Aproved (QA dept.)	Checked (QA dept.)	Prepared	Customer / Inspector
by	—		INSPECTION TEAM ☐WITNESSED ☑REVIEWED
Date Jul. 17 '03		Jul.-17-2003	LG E&C Oct. 15, 2003

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

SUBJECT	STEAM TURBINE /DISMANTLE CHECK (AFTER MECHANICAL RUNNING TEST)				
EBARA SER. No.	R021570803	MODEL	SRV-5DF	ITEM No.	CT-9901
MACH. No. –	ROTOR I.D. A				

■ Table : Inspection results

Portion	Check points (Surface condtion)	Result		Remarks (if any)
Journal bearing (Steam end side)	Upper bearing pads ① ②	☒ Acceptable	☐ Not acceptable	–
	Lower bearing pads ① ②	☒ Acceptable	☐ Not acceptable	–
	Journal ① ②	☒ Acceptable	☐ Not acceptable	–
Journal bearing (Exhaust end side)	Upper bearing pads ① ②	☒ Acceptable	☐ Not acceptable	–
	Lower bearing pads ① ②	☒ Acceptable	☐ Not acceptable	–
	Journal ① ②	☒ Acceptable	☐ Not acceptable	–
Thrust bearing	Active pads ① ②	☒ Acceptable	☐ Not acceptable	–
	Inactive pads ① ②	☒ Acceptable	☐ Not acceptable	–
	Collar (act. side) ① ②	☒ Acceptable	☐ Not acceptable	–
	Collar (Inact. side) ① ②	☒ Acceptable	☐ Not acceptable	–
Packing seal (Steam end side)	① ②	☒ Acceptable	☐ Not acceptable	–
Packing seal (Exhaust end side)	① ②	☒ Acceptable	☐ Not acceptable	–
Labyrince seal (Steam end side)	① ②	☒ Acceptable	☐ Not acceptable	–
Labyrince seal (Exhaust end side)	① ②	☒ Acceptable	☐ Not acceptable	–
Oil baffles (Steam end side)	① ②	☒ Acceptable	☐ Not acceptable	–
Oil baffles (Exhaust end side)	① ②	☒ Acceptable	☐ Not acceptable	–

① To be free from harmful damage such as heavy dents, scratches, rusts,etc.
② To be free from abnormal rubbing, wearing, cracking, etc.

Note : This dismantle check is after confirmation test.

■ Note Reference item number of quality plan : K03

TO	SET

Approved (QA dept.)	Checked (QA dept.)	Prepared	Customer / Inspector
by Date Oct. 3, 03	–	Oct. 3, 03	INSPECTION TEAM ☒WITNESSED ☐REVIEWED LG E&C Y. Tsutsumi Oct. 3, 2003

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

Inspection Activity		
Subvendor	Ebara	Customer

P.

SUBJECT	STEAM TURBINE /DISMANTLE CHECK OF CASING INTERIOR (AFTER MECHANICAL RUNNING TEST)		
EBARA SER. No.	R021570803	MODEL SRV-5DF	ITEM No. CT-9901
MACH. No. –	ROTOR I.D. A		

■ Table : Inspection results

Portion	Check points (Surface condtion)	Result	Remarks (if any)
Casing internal (Steam end side)	①	☑ Acceptable ☐ Not acceptable	–
Casing internal (Exhaust end side)	①	☑ Acceptable ☐ Not acceptable	–
Packing seal (Steam end side)	①②	☑ Acceptable ☐ Not acceptable	–
Packing seal (Exhaust end side)	①②	☑ Acceptable ☐ Not acceptable	–
Diaphragm labyrinth	①②	☑ Acceptable ☐ Not acceptable	–
Seal ring labyrinth	①②	☑ Acceptable ☐ Not acceptable	–
Rotor external	①	☑ Acceptable ☐ Not acceptable	–

① To be free from harmful damage such as heavy dents, scratches, rusts,etc.
② To be free from abnormal rubbing, wearing, cracking, etc.

Note : This dismantle check is after confirmation test.

■ Note Reference item number of quality plan : M02

TO	SET

Approved (QA dept.)	Checked (QA dept.)	Prepared	Customer / Inspector
by Date Oct. 3 '03	–	Oct. 3. '03	INSPECTION TEAM ☒WITNESSED ☐REVIEWED LG E&C Oct. 3. 2003

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

MATERIAL TEST REPORT
材料試験成績表

Date 14 MAR. '03 Report No. 030292

Manufacturer's
Order No. M02-12-040

Purchaser
御注文主 ELLIOTT EBARA TURBOMACHINERY CORPORATION

Name of Article
品 名 SHAFT (For A-ROTOR)

Material
材 質 ASTM A470 CL.4

Purchaser's Order No.
注文主番号 CD79968

Specification No.(仕様書No.) SMPS-ES-F15 REV.6 (EBARA STD.)

Plant/Project

Witness
立会者

Drawing No.
図 番 ES/8601600 REV.0

TYPE No. JSRV-5DF

WORK No. R021570803

S. Seo
Chief of Quality Control Section

Testing Machine No. : T-70 NG28,I-76 NG7,920,H-93 NG2

F.R. 1/2.0U 9.1S
Mass 1077 kg

Piece No. 製品番号	Size of Test Specimen Diameter Gauge Length 0.5" × 2"	Yield Strength $\sigma_{0.02}$ K.S.I (N/mm²)	Tensile Strength K.S.I (N/mm²)	Elongation %	Reduction of Area %		Impact Test Notch 2mmV Charpy Test temp. 20 ℃ ft-lb (J)	Hardness Brinell
	Test piece No. 試験片番号 Min. Max.	85 (587)	105 (725)	17	45	Test piece No. 試験片番号	Average Min.	Min. Max. 255
11181-203	11181-203L	94.6 (652)	112.3 (774)	24	65			235
	Test piece No. 試験片番号 Min. Max.	85 (587)	105 (725)	16	40	Test piece No. 試験片番号	Average Min. 20 (27)	Min. Max. 255
	11181-203T1	96.0 (662)	113.4 (782)	22	59	V-1	29.3 (39.8)	235
	11181-203T2	94.6 (652)	111.7 (770)	23	62	V-3	32.9 (44.5)	235

QUANTITY 1

Heat Treatment
N1. 900 ℃ × 16 h A.C.
T1. 650 ℃ × 16 h A.C.
N2. 845 ℃ × 9.5 h B.A.C.
T2. 645 ℃ × 12 h A.C.
S.R. 605 ℃ × 14 h F.C.

Chemical Composition 化学成分 %

Heat No. 溶解番号	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Sb
Min.			0.20				2.50		0.25	0.03	
Max.	0.28	0.10	0.60	0.012	0.015			0.75			
11181 Ladle	0.22	0.10	0.42	0.004	0.006		2.66	0.53	0.50	0.11	0.001
Product	0.22	0.10	0.43	0.004	0.006		2.68	0.54	0.51	0.10	0.001

Heat treatment
N. Normalizing
Q. Quenching
S.T. Solution Treatment
A. Annealing
T. Tempering
S.R. Stress Relieving
A.C. Air Cooling
O.C. Oil Cooling
F.C. Furnace Cooling
W.C. Water Cooling
P.H. Precipitation Hardening
B.C. Blast Cooling
W.S.P.C. Water Spray Cooling
B.A.C. Blast Air Cooling

Other
L. Longitudinal
Ta. Tangential
R. Radius
T.S. Top Side
M. Middle
B.S Bottom Side
$\sigma_{0.2}$ 0.2% offset
$\sigma_{0.02}$ 0.02% offset
F.R. Forging Ratio
H.T. Heat Treatment

* VACUUM CARBON DEOXIDIZED TREATMENT HAS BEEN MADE

ELLIOTT EBARA GROUP
☐ Witnessed
☑ Reviewed
EETC Q.C Dept.

R021570803
SRV-5DF
Item No.: CT-9901
A-Rotor
Part Name; Shaft

LGE&C
Y. Tsutsumi
Reviewed on July 22, 2003

PACIFIC STEEL MFG. CO., LTD. TOYAMA WORKS
大平洋製鋼株式会社 富山製造所

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ULTRASONIC INSPECTION REPORT
超音波探傷試験成績表

Date 5 MAR. '03 | Report No. 030292

Manufacturer's Order No. M02-12-040

Purchaser 御注文主: ELLIOTT EBARA TURBOMACHINERY CORPORATION

Name of Article 品名: SHAFT (For A-ROTOR)

Material 材質: ASTM A470 CL.4

Purchaser's Order No. 注文主番号: CD79968

Specification No. (仕様書No.): SMPS-ES-F15 REV.6 (EBARA STD.)

Witness

Plant/Project

Drawing No. 図番: ES/8601600 REV.0

TYPE No.: JSRV-5DF

WORK No.: R021570803

Examined	Reviewed	Approved
J. Sakai.	—	K. Shimada
SNT-TC-1A LEVEL II	SNT-TC-1A LEVEL III	SNT-TC-1A LEVEL III

Piece No. 製品番号: 11181-203

QUANTITY 1

Conditions of Ultrasonic Inspection 探傷条件

Defect Detector 探傷器: Kraut Krämer USM 3S

Couplant 接触媒質: Machine oil マシン油

Test Method 試験方法	Search Unit 探触子	Specified Sensitivity 探傷感度
Normal Beam Technique 垂直法	24 φmm / 2 MHz	Height of B_1 echo BG : 50 mm
Angle Beam Technique 斜角法	— mm / MHz	—
Double crystal Technique 分割形探触子法	— φmm / MHz	—

Procedure No. 要領書No.: MIP-T6-90-11B

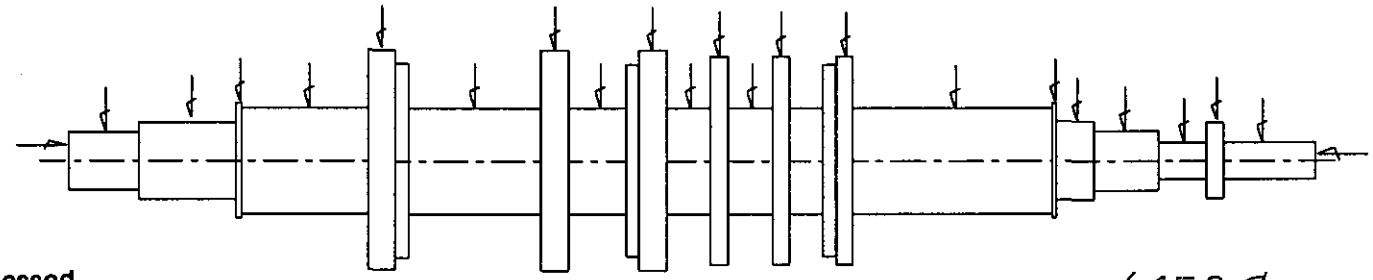
Applied Code (EBARA STD.) 適用規格: SPS-1002-40

Acceptance: 判定: ACCEPTABLE

Figure & Inspected Area 形状および探傷範囲

Shown by

ROX1570803
SRV-5DF
Item No.; CT-9901
A-Rotor
Part Name; Shaft



ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed

EETC Q.C Dept. T. Tokita

LGE&C
Y. Tsutsumi
Reviewed on July 22, 2003

PACIFIC STEEL MFG. CO., LTD. TOYAMA WORKS
大平洋製鋼株式会社 富山製造所

MAGNETIC PARTICLE INSPECTION REPORT
磁粉探傷試験成績表

Date 6 MAR. '03 | Report No. 030292

Manufacturer's Order No. M02-12-040

Purchaser 御注文主: ELLIOTT EBARA TURBOMACHINERY CORPORATION

Name of Article 品名: SHAFT (For A-ROTOR)

Material 材質: ASTM A470 CL.4

Purchaser's Order No. 注文主番号: CD79968

Specification No.(仕様書No.): SMPS-ES-F15 REV.6 [EBARA STD.] Witness

Drawing No. 図番: ES/8601600 REV.0

Plant/Project

TYPE No.: JSRV-5DF

WORK No.: R021570803

Examined	Reviewed	Approved
J. Sakai	—	K. Shimato
SNT-TC-1A LEVEL II	SNT-TC-1A LEVEL III	SNT-TC-1A LEVEL III

Piece No. 製品番号: 11181-203

QUANTITY 1

Conditions of Magnetic Particle Inspection 探傷条件

探傷器 Equipment: 電子磁気工業(株) Ez-3S Denshi Jiki Industry Co., Ltd, Ez-3S

Procedure No. 要領書No.: MIP-T6-90-11B

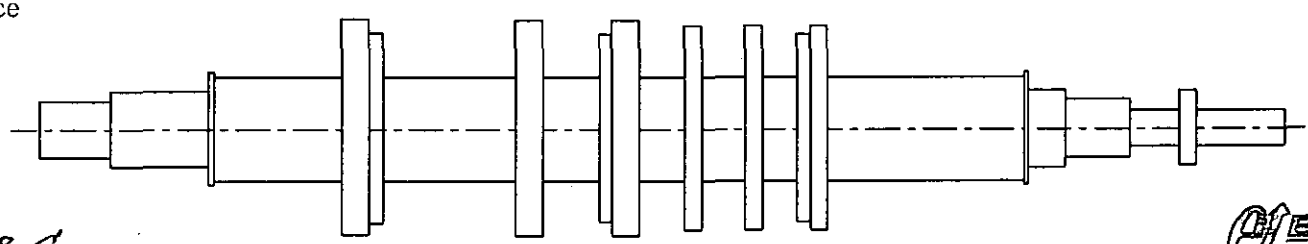
Test Method 試験方法	Magnetizing Current 磁化電流	Magnetic Particles 磁粉(マークテック)	Prod Spacing プロッド間隔	Standard Test Piece 標準試験片
Prod Method プロッド法	DC 1000 A	Wet Fluorescent	200 mm	JIS G0565-A1 30/100
Yoke Method 極間法	—	—	—	—
Coil Method コイル法	DC 2100 A	Wet Fluorescent	—	JIS G0565-A1 30/100

Applied Code 適用規格 [EBARA STD.]: SPS-1002-22

Acceptance: 判定: ACCEPTABLE

Figure & Inspected Area 形状および探傷範囲

Entire Surface



R021570803
SRV-5DF
Item No.; CT-9901
A-Rotor
Part Name; Shaft

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed

EETC Q.C Dept. T. Tobe

LGE&C
J. Tsutsumi
Reviewed on July 22, 2003

PACIFIC STEEL MFG. CO., LTD. TOYAMA WORKS
大平洋製鋼株式会社 富山製造所

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HEAT STABILITY TEST REPORT
加 熱 振 れ 試 験 成 績 表

Order No. 受注番号 M02-12-040

date 日付 14 MAR. '03

Report No. 成績表番号 030292

Purchaser 御注文主	ELLIOTT EBARA TURBOMACHINERY CORPORATION
Neme of Article 品名	SHAFT
Material 材質	ASTM A470 CL.4
Purchaser'S Order No. 客先注文番号	CD79968
Drawing No. 図番	ES/8601600 REV.0
Name of Project プラント名、プロジェクト名	
TYPE No.	JSRV-5DF
WORK No.	R021570803

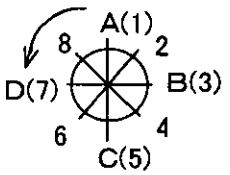
Applicable spec. [EBARA STD.]
適用仕様書
SMPS-ES-F15 REV.6
(SPS-1002-80)

Acceptance Standard
判定基準
(振れ規格) Spec.Deflection 0.050 mm
(軸芯振れ) Spec.Vector 0.025 mm

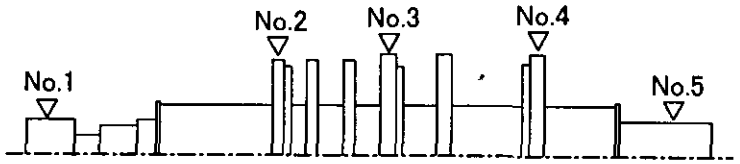
Piece No. 製品番号 11181-203

(試験条件)
Test Condition
(昇温速度)
Heating Rate 75 ℃/H
(保持温度)
Holding 605 ℃
(保持時間)
Holding Time 14 H
(降温速度)
Cooling Rate Furnace Cooling

(温度と振れの測定器位置)
Measured Position of Temperture & Deflection



R021570803
5RV-5DF
Item No.: CT-9901
A-Rotor
Part Name: Shaft



第1回 低温測定 1ST COLD MEASUREMENTS UNIT : 1/1000 mm

Position		1				2				3				4				5			
Date	Time	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	-	-	-	-
3/7	14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(A)	16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
加熱時最終測定		FINAL HOT MEASUREMENTS																			
3/8	12:00	0	0	0	0	0	-10	-5	5	0	-15	-10	0	0	-10	-10	0	0	0	0	0
	13:00	0	0	0	0	0	-10	-5	5	0	-15	-10	0	0	-10	-10	0	0	0	0	0
(B)	14:00	0	0	0	0	0	-10	-5	5	0	-15	-10	0	0	-10	-10	0	0	0	0	0
第2回 低温測定		2ND COLD MEASUREMENTS																			
3/10	8:00	0	0	0	0	0	-10	-5	0	0	-10	-10	0	0	-15	-10	0	0	0	0	0
	8:30	0	0	0	0	0	-10	-5	0	0	-10	-10	0	0	-15	-10	0	0	0	0	0
(C)	9:00	0	0	0	0	0	-10	-5	0	0	-10	-10	0	0	-15	-10	0	0	0	0	0
(B),(C)の振れ差異		DEFLECTION BETWEEN																			
(B)		0	0	0	0	0	-10	-5	5	0	-15	-10	0	0	-10	-10	0	0	0	0	0
(C)		0	0	0	0	0	-10	-5	0	0	-10	-10	0	0	-15	-10	0	0	0	0	0
(B)−(C)		0	0	0	0	0	0	0	5	0	-5	0	0	0	5	0	0	0	0	0	0
結果	RESULT	(Spec.Deflection)																			
		0				5				5				5				0			

ACCEPTANCE 判 定 **ACCEPTABLE**

☐ Witness 立会者 ☐ Reviewer 確認者 ELLIOTT EBARA GROUP EETC Q.C Dept.

☐ Witnessed ☑ Reviewed

Examined by 試験者 Y. Sunahara

Approved by 承認者 M. Sakiyama

LGE & C
F. Bertsami
Reviewed on July 22, 2003

Report No. 030292
Unit: 1/1000mm

		DATE	TIME	Temp. (℃)	Position																				Axie (mm)
					1				2				3				4				5				
					A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	
1		3/7	14:00	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
2	FIRST COLD	3/7	15:00	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
3		3/7	16:00	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
4		3/7	17:00	88	0	0	0	0	0	0	5	5	0	0	5	5	0	0	0	5	0	0	0	0	0.6
5		3/7	18:00	164	0	0	0	0	0	−5	0	5	0	−5	5	5	0	−5	0	5	0	0	0	0	1.5
6		3/7	19:00	236	0	0	0	0	0	−5	5	10	0	−10	0	10	0	−10	0	10	0	0	0	0	2.5
7	HEATING	3/7	20:00	312	0	0	0	0	0	−10	0	15	0	−15	−5	10	0	−10	0	10	0	0	0	0	3.4
8		3/7	21:00	387	0	0	0	0	0	−10	0	10	0	−15	−10	10	0	−10	−5	10	0	0	0	0	4.7
9		3/7	22:00	462	0	0	0	0	0	−10	−10	5	0	−15	−10	5	0	−10	−10	5	0	0	0	0	6.1
10		3/7	23:00	537	0	0	0	0	0	−10	−5	5	0	−15	−15	5	0	−10	−10	0	0	0	0	0	7.7
11		3/8	0:00	605	0	0	0	0	0	−10	−10	0	0	−15	−15	0	0	−10	−10	0	0	0	0	0	9.5
12		3/8	1:00	605	0	0	0	0	0	−5	−10	0	0	−10	−10	0	0	−10	−10	−5	0	0	0	0	12.0
13		3/8	2:00	605	0	0	0	0	0	−5	−5	0	0	−10	−10	0	0	−5	−5	0	0	0	0	0	13.5
14		3/8	3:00	605	0	0	0	0	0	−5	−5	0	0	−10	−10	−5	0	−5	−5	−5	0	0	0	0	14.1
15		3/8	4:00	605	0	0	0	0	0	−5	−5	0	0	−15	−15	0	0	−5	−5	0	0	0	0	0	14.3
16		3/8	5:00	604	0	0	0	0	0	−10	−10	0	0	−15	−10	0	0	−5	−5	0	0	0	0	0	14.5
17	HOLDING	3/8	6:00	605	0	0	0	0	0	−10	−5	5	0	−15	−10	0	0	−5	−5	0	0	0	0	0	14.5
18		3/8	7:00	604	0	0	0	0	0	−10	−5	5	0	−10	−10	0	0	−10	−10	5	0	0	0	0	14.6
19		3/8	8:00	606	0	0	0	0	0	−10	−5	5	0	−10	−10	0	0	−10	−10	0	0	0	0	0	14.6
20		3/8	9:00	605	0	0	0	0	0	−5	−5	5	0	−10	−5	0	0	−15	−10	5	0	0	0	0	14.7
21		3/8	10:00	604	0	0	0	0	0	−10	−5	5	0	−10	−10	0	0	−10	−10	0	0	0	0	0	14.8
22		3/8	11:00	605	0	0	0	0	0	−10	−5	5	0	−15	−10	0	0	−10	−10	0	0	0	0	0	14.8
23		3/8	12:00	605	0	0	0	0	0	−10	−5	5	0	−15	−10	0	0	−10	−10	0	0	0	0	0	14.8
24	FINAL HOT	3/8	13:00	605	0	0	0	0	0	−10	−5	5	0	−15	−10	0	0	−10	−10	0	0	0	0	0	14.8
25		3/8	14:00	604	0	0	0	0	0	−10	−5	5	0	−15	−10	0	0	−10	−10	0	0	0	0	0	14.8
26		3/8	15:00	530	0	0	0	0	0	−10	−5	5	0	−15	−10	0	0	−15	−10	5	0	0	0	0	13.9
27		3/8	16:00	470	0	0	0	0	0	−10	−5	5	0	−15	−10	0	0	−10	−10	0	0	0	0	0	13.2
28		3/8	17:00	420	0	0	0	0	0	−10	−5	5	0	−15	−10	0	0	−10	−10	5	0	0	0	0	12.5
	COOLING																								
29		3/10	8:00	16	0	0	0	0	0	−10	−5	0	0	−10	−10	0	0	−15	−10	0	0	0	0	0	0.6
30	FINAL COLD	3/10	8:30	16	0	0	0	0	0	−10	−5	0	0	−10	−10	0	0	−15	−10	0	0	0	0	0	0.6
31		3/10	9:00	16	0	0	0	0	0	−10	−5	0	0	−10	−10	0	0	−15	−10	0	0	0	0	0	0.6

PACIFIC STEEL MFG. CO., LTD. TOYAMA WORKS
大平洋製鋼株式会社 富山製造所

TEST CERTIFICATE

HITACHI
Hitachi Metals. Ltd.
Yasugi Works

Customer:EBARA CORPORATION, SODEGAURA PLANT

Order No.:CB96375

Spec. No.	Material		Condition	Heat No.	2G222K5	Date	JUL. 04, 2000
SMPS-E1-R02 REV. 6 (EBARA STD.)	Size	F19X29X2000L	HEAT TREATED	Number of Pieces	10	Report No.	007-0102-90
				Mass	91 KGS	Our Ref. No.	158-G366-01

JOB. NO. : -

ROZ1570803
SRV-5DF
Item No. ; CT-9901
A-Rotor
Part Name; Blade (1st. stage)

Chemical Composition

Elements	C %	SI %	MN %	P %	S %	NI %	CR %	MO %
Spec.	0.09 -0.15	MAX 0.50	MAX 1.00	MAX 0.03	MAX 0.03	MAX 0.50	11.5 -13.0	MAX 0.20
LADLE	0.14	0.29	0.57	0.023	0.001	0.47	11.63	0.16
Elements								
Spec.								
LADLE								

Item	Hardness (as Shipped) PRODUCTS	Hardness (as Shipped) TEST PIECE	Hardness after Heat Treated HT		
Spec.	HB 201-248	HB 201-248	-	-	-
Result	241- 241	241	TP	-	-
			-	-	-

Tensile Test at (RT)

Item	HT	TP	Yield Strength of 0.02% N/MM2	Tensile Strength N/MM2	Elongation (4D) %	Reduction of Area %
Spec.	-	L	MIN 483	MIN 690	MIN 20	MIN 60
	-	-	-	-	-	-
Result	-	-	572	780	24.7	67.3
	-	-	-	-	-	-
Specimen	12.50D*50.0GL					

Tensile Test at (-)

HT	TP	Yield Strength of -	Tensile Strength -	Elongation ( ) %	Reduction of Area %
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
Specimen	-				
HT	Item	IMPACT TEST 2V NOTCH RT			

Stress Rupture Test

Item	HT	TP	Temperature	Stress	Life (Hrs)	Elongation	Reduction of Area
Spec.	-	-	-	-	-	-	-
Result	-	-	-	-	-	-	-
	-	-	-	-	-	-	-

Item		Macro Structure				Grain Size		
	TP	-	-	-	-		-	
Spec.	-	-	-	-	-	Spec. TP	-	-
Result	-	-	-	-	-	-	-	-

Micro Structure

Item	HT	TP		
	-	-	-	-
Spec.	-	-	-	-
Result	-	-	GOOD	-

Impact Test

	L	J			
Spec.	TP	-	MIN41		-
Result	-	177	169	172	-
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-

Heat Treatment

Delivered Condition (HTO)
R:Q. 960° CX20MIN. OQ
T. 715° CX1 h AC

Test Specimen (HT)
-

Attachment ☐ Yes ☒ No

Non-Metallic Inclusion

Item	TP													
		-	-	-	-	-	-	-	-	-	-	-	-	-
Spec.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Result	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Inspection Item	
Dimensional Test	GOOD
Visual Test	GOOD
Ultrasonic Test	GOOD
Magnetic Particle Test	GOOD
Liquid Penetrant Test	-
Material Check	-

Conforms To All Drawing and/or Specification Requirements.
We hereby certify that the material described herein has been made and tested in accordance with the requirements of the purchase specification with satisfactory results.

S. Yoshikawa.

QUALITY ASSURANCE DEPARTMENT

PROJECT: -

LGE&C
Y. Tsutsumi
Reviewed on July 22, 2003

ELLIOTT EBARA GROUP ☐ Witnessed ☑ Reviewed

EETC Q.C Dept.

TEST CERTIFICATE

HITACHI
Hitachi Metals, Ltd.
Yasugi Works

Customer: EBARA CORPORATION, SODEGAURA PLANT

Order No.: CB96375

Spec. No.	Material	AISI403	Condition	Heat No.	2G222K1	Date	JUL. 04, 2000
SMPS-E1-R02 REV. 6 (EBARA STD.)	Size	F19X29X2000L	HEAT TREATED	Number of Pieces	17	Report No.	007-0104-20
				Mass	152 KGS	Our Ref. No.	158-G366-01

JOB. NO. : -

Chemical Composition

Elements	C %	SI %	MN %	P %	S %	NI %	CR %	MO %
Spec.	0.09 -0.15	MAX 0.50	MAX 1.00	MAX 0.03	MAX 0.03	MAX 0.50	11.5 -13.0	MAX 0.20
LADLE	0.14	0.29	0.57	0.023	0.001	0.47	11.63	0.16
Elements								
Spec.								
LADLE								

ROZ1570803
SRV-5DF
Item No.: CT-9901
A-Rotor
Part Name: Blade (1st. stage)

Item	Hardness (as Shipped) PRODUCTS	Hardness (as Shipped) TEST PIECE	Hardness after Heat Treated HT		
Spec.	HB 201-248	HB 201-248	-	-	-
Result	229-229	229	TP	-	-
			-	-	-

Tensile Test at (RT)

Item	HT	TP	Yield Strength of 0.02% N/MM2	Tensile Strength N/MM2	Elongation (4D) %	Reduction of Area %
Spec.	-	L	MIN 483	MIN 690	MIN 20	MIN 60
	-	-	-	-	-	-
Result	-	-	560	778	25.3	67.3
	-	-	-	-	-	-
Specimen	12.50D*50.0GL					

Tensile Test at (-)

HT	TP	Yield Strength of	Tensile Strength	Elongation ( ) %	Reduction of Area %
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
Specimen	-				

Stress Rupture Test

Item	HT	TP	Temperature	Stress	Life (Hrs)	Elongation	Reduction of Area
Spec.	-	-	-	-	-	-	-
Result	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-

HT	Item	IMPACT TEST 2V NOTCH	RT
-			

Macro Structure

Item	TP			
Spec.	-	-	-	-
Result	-	-	-	-

Grain Size: Spec. - ; TP - -

Micro Structure

Item	HT	TP		
Spec.	-	-	-	-
Result	-	-	GOOD	-

Impact Test

		L	J			
Spec.		TP	MIN41			-
Result		-	183	174	177	-
		-	-	-	-	-
		-	-	-	-	-
		-	-	-	-	-

Heat Treatment

Delivered Condition (HTO): R: Q. 960° CX20MIN. OQ
T. 715° CX1 h AC

Test Specimen (HT): -

Attachment ☐ Yes ☒ No

Non-Metallic Inclusion

Item	TP													
		-	-	-	-	-	-	-	-	-	-	-	-	-
Spec.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Result	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Inspection Item	
Dimensional Test	GOOD
Visual Test	GOOD
Ultrasonic Test	GOOD
Magnetic Particle Test	GOOD
Liquid Penetrant Test	-
Material Check	-

Conforms To All Drawing and/or Specification Requirements.
We hereby certify that the material described herein has been made and tested in accordance with the requirements of the purchase specification with satisfactory results.

S. Yoshikawa.

QUALITY ASSURANCE DEPARTMENT

PROJECT: -

LGE&C
J. Pantsumi
Reviewed on July 22, 2003

ELLIOTT EBARA GROUP
☐ Witnessed
☒ Reviewed
EETC Q.C Dept.

64

TEST CERTIFICATE

HITACHI
Hitachi Metals. Ltd.
Yasugi Works

Customer:EBARA CORPORATION, SODEGAURA PLANT

Order No.:CC74113

Spec. No.	Material	AISI403	Condition	Heat No.	2K375S4	Date	DEC. 26, 2001
SMPS-E1-R02 REV. 6	Size	F23X26X2000L	HEAT TREATED	Number of Pieces	99	Report No.	112-2413-70
{EBARA STD.}				Mass	996 KGS	Our Ref. No.	158-L740-02

JOB. NO. : -

ROZ1570803
SRV-5DF
Item No.: CT-9901
A-Rotor
Part Name: Blade (2nd. stage)

Chemical Composition

Elements	C %	SI %	MN %	P %	S %	NI %	CR %	MO %
Spec.	0.09 -0.15	MAX 0.50	MAX 1.00	MAX 0.03	MAX 0.03	MAX 0.50	11.5 -13.0	MAX 0.20
LADLE	0.12	0.23	0.56	0.021	0.001	0.48	11.63	0.17
Elements								
Spec.								
LADLE								

Item	Hardness (as Shipped) PRODUCTS	Hardness (as Shipped) TEST PIECE	Hardness after Heat Treated HT	Hardness after Heat Treated -	Hardness after Heat Treated -
Spec.	HB 201-248	HB 201-248	TP	-	-
Result	235-235	235	-	-	-

Tensile Test at (RT)

Item	HT	TP	Yield Strength of 0.02%	Tensile Strength	Elongation (4D)	Reduction of Area
			N/MM2	N/MM2	%	%
Spec.	-	L	MIN 483	MIN 690	MIN 20	MIN 60
	-	-	-	-	-	-
Result	-	-	540	749	26.6	71.5
	-	-	-	-	-	-
Specimen	12.50D*50.0GL					

Tensile Test at (-)

HT	TP	Yield Strength of	Tensile Strength	Elongation ( )	Reduction of Area
		-	-	%	%
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
Specimen	-				

HT	Item	IMPACT TEST 2V NOTCH RT
-	-	-

Stress Rupture Test

Item	HT	TP	Temperature	Stress	Life (Hrs)	Elongation	Reduction of Area
Spec.	-	-	-	-	-	-	-
Result	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-

Macro Structure

Item	P
Spec.	-
Result	-

Grain Size: Spec. - / TP -

Micro Structure

Item	HT	TP		
Spec.	-	-	-	-
Result	-	-	GOOD	-

Impact Test

	L	J MIN41			
Spec.	TP	-	-	-	-
Result	-	163	162	148	-
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-

Heat Treatment

Delivered Condition (HTO)
R:Q. 960° CX30MIN. OQ
T. 715° CX1 h AC

Test Specimen (HT) -

Attachment ☐ Yes ☒ No

Non-Metallic Inclusion

Item	TP													
Spec.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Result	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Inspection Item

Dimensional Test	GOOD
Visual Test	GOOD
Ultrasonic Test	GOOD
Magnetic Particle Test	GOOD
Liquid Penetrant Test	-
Material Check	GOOD

Conforms To All Drawing and/or Specification Requirements.
We hereby certify that the material described herein has been made and tested in accordance with the requirements of the purchase specification with satisfactory results.

S. Yoshikawa.

QUALITY ASSURANCE DEPARTMENT

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PROJECT: -

LGE&C
Y. Tsutsumi
Reviewed on July 22, 2003

ELLIOTT. EBARA GROUP ☐ Witnessed ☑ Reviewed

EETC Q.C Dept.

ROZ1570803
SRV-5DF
Item No.: CT-9901
A-Rotor
Part Name: Blade (3rd. stage)

試験成績表
TEST CERTIFICATE

HITACHI
Hitachi Metals. Ltd.
Yasugi Works

御注文主:EBARA CORPORATION, SODEGAURA PLANT
Customer

御中

御注文番号:CC89009
Order No.

スペック番号 Spec.No.	鋼種 Material	ASTM A565 GR.616	納入状態 Condition	溶解番号 Heat No.	2K806S1	発行日 Date	2002-02-27
SMPS-E1-R04 REV.5 〔EBARA STD.〕	寸法 Size	F23X26X2000L	HEAT TREATED	個数 Number of Pieces	38	成績表番号 Report No.	202-2510-10
				質量 Mass	382 KGS	参照 Our Ref.No.	158-M582-04

製番 (JOB. NO.) :R001600302

化学成分 Chemical Composition

元素名 Elements	C %	SI %	MN %	P %	S %	NI %	CR %	W %	MO %	V %	CO %	AL %	SN %	TI %
規格 Spec.	0.20 -0.25	0.20 -0.50	0.50 -1.00	MAX 0.025	MAX 0.025	0.50 -1.00	11.00 -12.50	0.90 -1.25	0.90 -1.25	0.20 -0.30	MAX 0.25	MAX 0.05	MAX 0.04	MAX 0.05
LADLE	0.22	0.25	0.80	0.019	0.001	0.81	11.08	0.91	0.91	0.20	0.04	0.003	0.001	0.004

項目 Item	納入硬さ Hardness (as Shipped) 製品	試験片	熱処理硬さ Hardness after Heat Treated HT	TP	地疵又は清浄度 Macro-Streak-Flaw or Cleanliness 規格 Spec.	段 Step T	P	項目 Item	T	P
規格 Spec.	HB 255-331	HB	-	-	-	-	-	規格 Spec.	-	-
結果 Result	302-302	302	-	-	-	結果 Result -	-	結果 Result	-	-

引張試験 Tensile Test at (RT)

項目 Item	HT TP	耐力 降伏点 Pt.Str at 0.2%	引張強さ Tensile Strength	伸び Elong. (4D)	絞り Red.of Area
		N/MM2	N/MM2	%	%
規格 Spec.	L	MIN 690	MIN 863	MIN 15	MIN 45
	-	-	-	-	-
結果 Result		829	1002	17.0	48.2

試験片 Specimen 12.50D*50.0GL

HT 衝撃試験 Impact Test

項目 Item					
規格 Spec.	-	TP	-	-	-
結果 Result	-	-	-	-	-

焼入性 Hardenability 規格 Spec. HT TP - - -
結果 Result - - -

クリープ試験 Stress Rupture

項目 Item	HT	TP	温度 Temp.	応力 Stress	寿命 Life (Hrs)	伸び El.(%)	絞り (%) Red.of Area
規格 Spec.	-	-	-	-	-	-	-
結果 Result	-	-	-	-	-	-	-

熱処理 Heat Treatment
納入状態 Delivered Condition (HTO)
R:Q. 1038°C X30MIN. OQ
T. 660°C X1 h AC

試験片 Test Specimen (HT.)

マクロ組織 Macro Structure

項目 Item	TP			
規格 Spec.	-	-	-	-
結果 Result	GOOD	-	-	-

HT 結晶粒度 Grain Size

項目 Item	Spec. TP		
規格 Spec.	-	-	
結果 Result	-	-	-

脱炭又は表面汚染 Decarburization or Surface Contamination

項目 Item			
規格 Spec.	-	-	-
結果 Result	-	-	-

検査項目 Inspection Item

寸法検査	:Dimensional Test	GOOD
外観検査	:Visual Test	GOOD
超音波検査	:Ultrasonic Test	GOOD
磁気探傷検査	:Magnetic Particle Test	GOOD
浸透探傷検査	:Liquid Penetrant Test	-
材質確認	:Material Check	GOOD

ミクロ組織 Micro Structure

項目 Item	HT TP			
規格 Spec.	-	-	-	-
結果 Result	-	GOOD	-	-

非金属介在物 Non-Metallic Inclusion

TP	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-

添付資料 Attachment ☒ 有 Yes ☐ 無 No

要求図面/仕様書に適合する。
Conforms To All Draning and/or Specification Requirements.
この材料は、注文規格の要求を満足していることを証明します。
We hereby certify that the material described herein has been made and tested in accordance with the requirements of the purchase specification with satisfactory results.

QUALITY ASSURANCE DEPARTMENT

プラント名 (PROJECT) :2SNV-8

LGE&C
Y. Tsutsumi
Reviewed on July 22, 2003

ELLIOTT EBARA GROUP
☐ Witnessed
☑ Reviewed
EETC Q.C Dept.

R0Z1570803
SRV-5DF
Item No.: CT-9901
A-Rotor
Part Name: Blade (3rd. stage)

TEST CERTIFICATE

HITACHI
Hitachi Metals, Ltd.
Yasugi Works

Customer: EBARA CORPORATION, SODEGAURA PLANT

Order No.: CB77298

Spec. No.	Material	ASTM A565 GR.616	Condition	Heat No.	9J651S1	Date	MAR. 18, 2000
SMPS-E1-R04 REV.4 (EBARA STD.)	Size	F23X26X2000L	HEAT TREATED	Number of Pieces	7	Report No.	003-1712-00
		JOB. NO.: R990430303		Mass	71 KGS	Our Ref. No.	158-F185-01

Chemical Composition

Elements	C %	SI %	MN %	P %	S %	NI %	CR %	W %	MO %	V %	CO %	AL %	SN %	TI %
Spec.	0.20 -0.25	0.20 -0.50	0.50 -1.00	MAX 0.025	MAX 0.025	0.50 -1.00	11.00 -12.50	0.90 -1.25	0.90 -1.25	0.20 -0.30	MAX 0.25	MAX 0.05	MAX 0.04	MAX 0.05
LADLE	0.23	0.29	0.79	0.019	0.001	0.79	11.42	0.93	0.94	0.24	0.05	0.008	0.001	0.005

Item	Hardness (as Shipped) PRODUCTS	Hardness (as Shipped) TEST PIECE	Hardness after Heat Treated HT		
Spec.	HB 255-331	HB	TP	-	-
Result	311-311	311		-	-

Macro-Streak-Flaw or Cleanliness: Spec. -; Step T P: - - -; Result: - - -

Item	HT	TP	-	-
Spec.			-	-
Result			-	-

Tensile Test at (RT) HT

Item	HT	TP	Yield Strength or 0.2%	Tensile Strength	Elongation (4D)	Reduction of Area
			N/MM2	N/MM2	%	%
Spec.		L	MIN 690	MIN 863	MIN 15	MIN 45
			-	-	-	-
Result			851	1022	18.8	51.0

Specimen: 12.50D*50.0GL

Impact Test at

Item		-		-
Spec.	-	-		-
	TP	-	-	-
Result	-	-	-	-

Hardenability	HT TP			
Spec.		-	-	-
Result		-	-	-

Stress Rupture

Item	HT	TP	Temperature	Stress	Life (Hrs)	Elongation(%)	Reduction of Area
Spec.		-	-	-	-	-	-
Result		-	-	-	-	-	-

Heat Treatment

Delivered Condition(HTO) Test Specimen (HT)
R: Q. 1038°CX30MIN. OQ
T. 660°CX1 h AC

ELLIOTT EBARA GROUP
☐ Witnessed
☒ Reviewed
EETC Q.C Dept. [signature]

Macro Structure

Item	-	-	-	-
Spec.	-	-	-	-
Result	GOOD	-	-	-

Grain Size (HT)

Item	-		
Spec.	TP	-	-
Result	-	-	-

Decarburization or Surface Contamination

Item	-	-	-
Spec. HT TP	-	-	-
Result	-	-	-

Inspection Item

Dimensional Test	GOOD
Visual Test	GOOD
Ultrasonic Test	GOOD
Magnetic Perticle Test	GOOD
Liquid Penetrant Test	-
Material Check	-

Micro Structure

Item	HT	TP	-	-	-
Spec.		-	-	-	-
Result		-	-	-	-

Non-Metallic Inclusion

TP	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-

Attachment ☒ Yes ☐ No

Conforms To All Drawing and/or Specification Requirements.
We hereby certify that the material described herein has been made and tested in accordance with the requirements of the purchase specification with satisfactory results.

S. Yoshikawa
QUALITY ASSURANCE DEPARTMENT

PROJECT: SBEG-5 DC

LGE & C
Y. Tsutsumi
Reviewed on July 22, 2003

ROZ1570803
SRV-5DF
Item No.; CT-9901
A-Rotor
Part Name: Blade (3rd. stage)

TEST CERTIFICATE

HITACHI
Hitachi Metals. Ltd.
Yasugi Works

Customer: EBARA CORPORATION, SODEGAURA PLANT

Order No.: CC21394

Spec. No.	Material	ASTM A565 GR.616	Condition	Heat No.	9M045S1	Date	JAN. 08, 2001
SMPS-E1-R04 REV.4 (EBARA STD.)	Size	F23X26X2000L	HEAT TREATED	Number of Pieces	13	Report No.	012-2616-20
				Mass	133 KGS	Our Ref. No.	158-H648-01

JOB. NO.: R991119103

Chemical Composition

Elements	C %	SI %	MN %	P %	S %	NI %	CR %	W %	MO %	V %	CO %	AL %	SN %	TI %
Spec.	0.20 -0.25	0.20 -0.50	0.50 -1.00	MAX 0.025	MAX 0.025	0.50 -1.00	11.00 -12.50	0.90 -1.25	0.90 -1.25	0.20 -0.30	MAX 0.25	MAX 0.05	MAX 0.04	MAX 0.05
LADLE	0.22	0.26	0.78	0.021	0.001	0.81	11.44	0.93	0.95	0.23	0.03	0.009	0.002	0.004

Item	Hardness (as Shipped) PRODUCTS	Hardness (as Shipped) TEST PIECE	Hardness after Heat Treated HT	Hardness after Heat Treated –	Hardness after Heat Treated –
Spec.	HB 255-331	HB	TP	–	–
Result	311-311	311	–	–	–

Macro-Streak-Flaw or Cleanliness				
Spec.		–	–	–
Step	T P	–	–	–
Result	–	–	–	–

Item	HT	TP	–	–
Spec.	–	–	–	–
Result	–	–	–	–

Tensile Test at (RT)

Item	HT	TP	Yield Strength at 0.2% N/MM2	Tensile Strength N/MM2	Elongation (4D) %	Reduction of Area %
Spec.	–	L	MIN 690	MIN 863	MIN 15	MIN 45
	–	–	–	–	–	–
Result	–	–	851	1020	18.2	50.4
Specimen	12.50D*50.0GL					

Impact Test at HT

Item	HT	TP	–	–	–
Spec.	–	TP	–	–	–
Result	–	–	–	–	–

Hardenability	HT	TP	–	–	–
Spec.					
Result	–	–	–	–	–

Stress Rupture

Item	HT	TP	Temperature	Stress	Life (Hrs)	Elongation(%)	Reduction of Area
Spec.	–	–	–	–	–	–	–
Result	–	–	–	–	–	–	–

Heat Treatment

Delivered Condition(HTD) Test Specimen (HT)
R:Q. 1038° CX30MIN. OQ
T. 660° CX1 h AC

ELLIOTT ECARA GROUP ☐ Witnessed ☑ Reviewed

EETC Q.C Dept.

Macro Structure

Item	HT	TP	–	–	–	–
Spec.	–	–	–	–	–	–
Result	–	GOOD	–	–	–	–

Grain Size HT

Item	–	–	–
Spec. TP	–	–	–
Result	–	–	–

Decarburization or Surface Contamination

Item	–	–	–
Spec. HT TP	–	–	–
Result	–	–	–

Inspection Item

Dimensional Test	GOOD
Visual Test	GOOD
Ultrasonic Test	GOOD
Magnetic Particle Test	GOOD
Liquid Penetrant Test	–
Material Check	–

Micro Structure

Item	HT	TP	–	–	–
Spec.	–	–	–	–	–
Result	–	–	–	–	–

Non-Metallic Inclusion

	–				–										
TP	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Result	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Attachment * Yes ☐ No

Conforms To All Drawing and/or Specification Requirements.
We hereby certify that the material described herein has been made and tested in accordance with the requirements of the purchase specification with satisfactory results.

S. Yoshikawa

QUALITY ASSURANCE DEPARTMENT

PROJECT: SBEG-4

LGE & C
J. Tsutsumi
Reviewed on July 22, 2003

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試験成績表
TEST CERTIFICATE

HITACHI
Hitachi Metals. Ltd.
Yasugi Works

御注文主: (株) 荏原エリオット
Customer 本社

御中

御注文番号:CD20033
Order No.

スペック番号 Spec.No.	鋼種 Material	12CR-0.12CB-MOD	納入状態 Condition	溶解番号 Heat No.	9K447K1	発行日 Date	2002-08-07
SMPS-EI-R06 REV.4 (EBARA STD.)	寸法 Size	F24X35X2000L	HEAT TREATED	個数 Number of Pieces	16	成績表番号 Report No.	207-3104-70
				質量 Mass	222 KGS	参照 Our Ref.No.	151-NA7P-01

製番 (JOB. NO.) :R010871403

ROZ1570803
SRV-15DF
Item No.: CT-9901
A-Rotor
Part Name: Blade (4th. stage)

化学成分 Chemical Composition

元素名 Elements	C %	SI %	MN %	P %	S %	NI %	CR %	NB %
規格 Spec.	0.13 -0.18	MAX 0.50	0.40 -0.60	MAX 0.025	MAX 0.010	MAX 0.50	11.50 -13.00	0.15 -0.25
LADLE	0.14	0.36	0.48	0.021	0.002	0.41	12.17	0.20

項目 Item	納入硬さ Hardness (as Shipped) 製品	試験片	熱処理硬さ Hardness after Heat Treated			地疵又は清浄度 Macro-Streak-Flaw or Cleanliness			
規格 Spec.	HB 255-302	HB 255-302	HT	–	–	規格 Spec.	–	–	–
結果 Result	269-269	269	–			段 Step	T	–	–
			TP	–	–		P	–	–
			–	–	–	結果 Result	–	–	–

項目 Item	HT	–	–
規格 Spec.	TP	–	–
結果 Result	–	–	–

引張試験 Tensile Test at (RT)

項目 Item	HT TP	耐力 降伏点 P.Str at 0.2%	引張強さ Tensile Strength	伸び Elong. (4D)	絞り Red.of Area
		N/MM2	N/MM2	%	%
規格 Spec.	L	MIN 690	MIN 828	MIN 17	MIN 55
	–	–	–	–	–
結果 Result	–	764	892	20.9	66.2

試験片 Specimen 12.50D*50.0GL

HT 衝撃試験 Impact Test

項目 Item	衝撃試験 2V NOTCH			RT
規格 Spec.	L	J MIN54		–
	TP	–	–	–
結果 Result	–	127	109	106

焼入性 Hardenability

規格 Spec.	HT TP	–	–	–
結果 Result	–	–	–	–

応力破断試験 Stress Rupture

項目 Item	HT	TP	温度 Temp.	応力 Stress	寿命 Life (Hrs)	伸び El.(%)	絞り (%) Red.of Area
規格 Spec.	–	–	–	–	–	–	–
結果 Result	–	–	–	–	–	–	–

熱処理 Heat Treatment

納入状態 Delivered Condition(HTO) 試験片 Test Specimen (HT)

R:Q.960°CX30MIN. OQ
T.610°CX1 h AC

ELLIOTT EDARA GROUP ☐Witnessed ☑Reviewed

EETC Q.C Dept.

マクロ組織 Macro Structure

項目 Item	HT TP	–	–	–	–
規格 Spec.	–	–	–	–	–
結果 Result	–	–	–	–	–

結晶粒度 Grain Size

項目 Item	Spec. / TP	–	–
規格 Spec.			
結果 Result	–	–	–

脱炭又は表面汚染 Decarburization or Surface Contamination

項目 Item		–	–	–
規格 Spec.	HT TP	–	–	–
結果 Result	–	–	–	–

検査項目 Inspection Item

寸法検査	:Dimensional Test	GOOD
外観検査	:Visual Test	GOOD
超音波検査	:Ultrasonic Test	GOOD
磁気探傷検査	:Magnetic Particle Test	GOOD
浸透探傷検査	:Liquid Penetrant Test	–
材質確認	:Material Check	GOOD

ミクロ組織 Micro Structure

項目 Item	HT TP	–	–	–
規格 Spec.	–	–	–	–
結果 Result	–	GOOD	–	–

非金属介在物 Non-Metallic Inclusion

	–													
TP	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	–	–	–	–	–	–	–	–	–	–	–	–	–	–

添付資料 Attachment ☑有 Yes ☐無 No

要求図面/仕様書に適合する。
Conforms To All Drawing and/or Specification Requirements.
この材料は、注文規格の要求を満足していることを証明します。
We hereby certify that the material described herein has been made and tested in accordance with the requirements of the purchase specification with satisfactory results.

QUALITY ASSURANCE DEPARTMENT

姫崎 '02.8.21 03982

プラント名 (PROJECT) :SBEG-4

LGE&C
J. Tsutsumi
Reviewed on July 22, 2002

試験成績表
TEST CERTIFICATE

HITACHI
Hitachi Metals, Ltd.
Yasugi Works

御注文主: (株) 荏原エリオット 本社 御中
Customer

御注文番号 Order No.: CD80935

スペック番号 Spec.No.	鋼種 Material	12CR-0.12CB-MOD	納入状態 Condition	溶解番号 Heat No.	9S018K1	発行日 Date	2003-03-25
SMPS-EI-R06 REV.4	寸法 Size	F40X45X2000L	HEAT TREATED	個数 Number of Pieces	14	成績表番号 Report No.	303-1411-90
(EBARA STD.)				質量 Mass	414 KGS	参照 Our Ref.No.	151-PSWF-01

製番 (JOB. NO.) :R021570803

化学成分 Chemical Composition

元素名 Elements	C %	SI %	MN %	P %	S %	NI %	CR %	NB %
規格 Spec.	0.13-0.18	MAX 0.50	0.40-0.60	MAX 0.025	MAX 0.010	MAX 0.50	11.50-13.00	0.15-0.25
LADLE	0.15	0.27	0.51	0.019	0.003	0.38	12.04	0.20

R021570803
SRV-5DF
Item No.: CT-9901
A-Rotor
Part Name: Blade (5th. 5DFth. stage)

納入硬さ Hardness (as Shipped)

項目 Item	製品	試験片
規格 Spec.	HB 255-302	HB 255-302
結果 Result	277-277	277

熱処理硬さ Hardness after Heat Treated: HT – / TP – : –

地疵又は清浄度 Macro-Streak-Flaw or Cleanliness: 規格 Spec. –; 段 Step T P –; 結果 Result –

引張試験 Tensile Test at (RT) HT

項目 Item	HT/TP	耐力 Yield Str. at 0.2%	引張強さ Tensile Strength	伸び Elong. (4D)	絞り Red. of Area
規格 Spec.	L	N/MM2 MIN 690	N/MM2 MIN 828	% MIN 17	% MIN 55
		–	–	–	–
結果 Result		747	878	21.2	65.9

試験片 Specimen 12.50D*50.0GL

衝撃試験 Impact Test (HT)

項目 Item	衝撃試験 2V NOTCH			RT
規格 Spec.	L	J MIN54		–
	TP	–	–	–
結果 Result	–	119	117	116

焼入性 Hardenability: 規格 Spec. –; 結果 Result –

ラプチャー試験 Stress Rupture

項目 Item	HT	T P	温度 Temp.	応力 Stress	寿命 Life (Hrs)	伸び El.(%)	絞り Red. of Area (%)
規格 Spec.		–	–	–	–	–	–
結果 Result		–	–	–	–	–	–

熱処理 Heat Treatment 納入状態 Delivered Condition (HTO) 試験片 Test Specimen (HT)
R:Q.960°CX30MIN. OQ
T.610°CX2 h AC

ELLIOTT EBARA GROUP
☐ Witnessed
☒ Reviewed
EETC Q.C Dept.

マクロ組織 Macro Structure: 規格 Spec. –; 結果 Result –

結晶粒度 Grain Size HT: 規格 Spec. TP –; 結果 Result –

脱炭又は表面汚染 Decarburization or Surface Contamination: 規格 Spec. HT TP –; 結果 Result –

検査項目 Inspection Item		
寸法検査	Dimensional Test	GOOD
外観検査	Visual Test	GOOD
超音波検査	Ultrasonic Test	GOOD
磁気探傷検査	Magnetic Particle Test	GOOD
浸透探傷検査	Liquid Penetrant Test	–
材質確認	Material Check	GOOD

ミクロ組織 Micro Structure

項目 Item	HT	TP			
規格 Spec.	–	–	–	–	–
結果 Result	–	GOOD	–	–	–

非金属介在物 Non-Metallic Inclusion: TP –

添付資料 Attachment ☒ 有 Yes ☐ 無 No

要求図面/仕様書に適合する。
Conforms To All Drawing and/or Specification Requirements.
この材料は,注文規格の要求を満足していることを証明します。
We hereby certify that the material described herein has been made and tested in accordance with the requirements of the purchase specification with satisfactory results.

QUALITY ASSURANCE DEPARTMENT

プラント名 (PROJECT) :SRV-5DF(ヨビローター)

LGE&C
J. Tsutsumi
Reviewed on July 22, 2003

試験成績表
TEST CERTIFICATE

HITACHI
Hitachi Metals, Ltd.
Yasugi Works

御注文主: (株) 荏原エリオット
Customer 本社

御中

御注文番号:CD80935
Order No.

スペック番号 Spec.No.	鋼種 Material		納入状態 Condition	溶解番号 Heat No.		発行日 Date	
SMPS-E1-R06 REV.4 〔EBARA STD.〕	寸法 Size	12CR-0.12CB-MOD F40X45X2000L	HEAT TREATED	個数 Number of Pieces	16	成績表番号 Report No.	303-1834-30
				質量 Mass	470 KGS	参照 Our Ref.No.	151-PSWF-01

製番 (JOB. NO.) :R021570803

ROZ1570803
SRV-5DF
Item No.: CT-9901
A-Rozor
Part Name: Blade (5th., 5DFth. stage)

化学成分 Chemical Composition

元素名 Elements	C %	SI %	MN %	P %	S %	NI %	CR %	NB %
規格 Spec.	0.13 -0.18	MAX 0.50	0.40 -0.60	MAX 0.025	MAX 0.010	MAX 0.50	11.50 -13.00	0.15 -0.25
LADLE	0.15	0.34	0.50	0.019	0.001	0.39	12.04	0.20

項目 Item	納入硬さ Hardness (as Shipped) 製品	試験片	熱処理硬さ Hardness after Heat Treated HT			地疵又は清浄度 Micro-Streak-Flaw or Cleanliness 規格 Spec.			項目 Item		
規格 Spec.	HB 255-302	HB 255-302	—	—	—	段 Step T	—	—	—	規格 Spec.	—
結果 Result	277-277	277	TP —	—	—	P	—	—	—	結果 Result	—

引張試験 Tensile Test at (RT)

項目 Item	HT TP	耐力 降伏点 Pr.Str of 0.2%	引張強さ Tensile Strength	伸び Elong. (4D)	絞り Red.of Area
		N/MM2	N/MM2	%	%
規格 Spec.	L	MIN 690	MIN 828	MIN 17	MIN 55
		—	—	—	—
結果 Result		757	892	21.6	61.1

試験片 Specimen 12.50D*50.0GL

HT 衝撃試験 Impact Test

項目 Item	衝撃試験 2V NOTCH RT				
規格 Spec.	L	J MIN54			—
	TP	—	—	—	
結果 Result	—	86	91	76	—

焼入性 Hardenability

	規格 Spec.	HT TP	—	—	—
	結果 Result	—	—	—	—

ｽﾄﾚｽ試験 Stress Rupture

項目 Item	HT	T P	温度 Temp.	応力 Stress	寿命 Life (Hrs)	伸び El.(%)	絞り (%) Red.of Area
規格 Spec.	—	—	—	—	—	—	—
結果 Result	—	—	—	—	—	—	—

熱処理 Heat Treatment

納入状態 Delivered Condition (HTO)
R:Q.960°CX30MIN. OQ
T.610°CX2 h AC

試験片 Test Specimen (HT) —

ELLIOTT EBARA GROUP ☐ Witnessed ☑ Reviewed

EETC Q.C Dept.

マクロ組織 Macro Structure

項目 Item	HT TP			
規格 Spec.	—	—	—	—
結果 Result	—	—	—	—

結晶粒度 Grain Size

項目 Item	Spec. TP		
規格 Spec.	—	—	
結果 Result	—	—	

脱炭又は表面汚染 Decarburization or Surface Contamination

項目 Item			
規格 Spec.	HT TP	—	—
結果 Result	—	—	—

検査項目 Inspection Item

寸法検査 :Dimensional Test	GOOD
外観検査 :Visual Test	GOOD
超音波検査 :Ultrasonic Test	GOOD
磁気探傷検査 :Magnetic Particle Test	GOOD
浸透探傷検査 :Liquid Penetrant Test	—
材質確認 :Material Check	GOOD

ミクロ組織 Micro Structure

項目 Item	HT TP			
規格 Spec.	—	—	—	—
結果 Result	—	GOOD	—	—

非金属介在物 Non-Metallic Inclusion

	T P	—	—	—	—	—	—	—	—	—	—	—	—	—
		—	—	—	—	—	—	—	—	—	—	—	—	—

添付資料 Attachment ☑ 有 Yes ☐ 無 No

要求図面/仕様書に適合する。
Conforms To All Drawing and/or Specification Requirements.
この材料は、注文規格の要求を満足していることを証明します。
We hereby certify that the material described herein has been made and tested in accordance with the requirements of the purchase specification with satisfactory results.

QUALITY ASSURANCE DEPARTMENT

プラント名 (PROJECT) :SRV-5DF(ヨビロータ-)

LGE & C
G. Pantsuni
Reviewed on July 22, 2003

71

SUBJECT	STEAM TURBINE ROTOR / HIGH SPEED BALANCE RECORD		
EBARA SER. No.	R021570803	MODEL SRV-5DF	ITEM No. CT-9901
MACH. No. -	ROTOR I.D. A		

■ Condition :

Type of balancing machine ■ Schenk DH4 □ Schenk DH7

Rotor weight 1000 kgf

Test speeds are showm below. Holding time at overspeed is Min. 3 min.

Correction method □ Removed ■ Added

■ Table : Measured shaft vibration amplitude data.

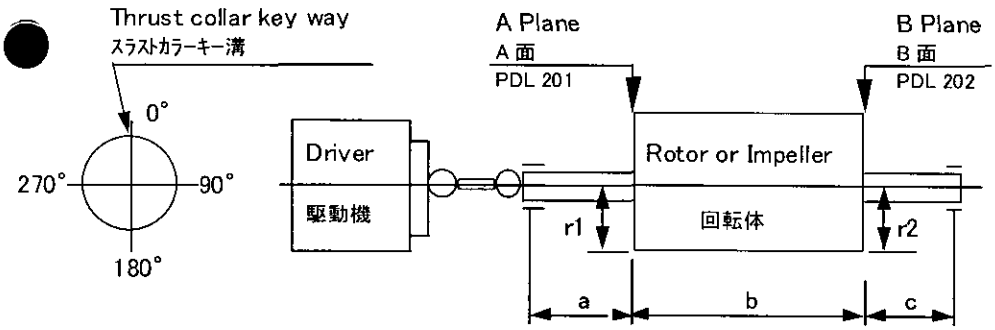
Shaft vibration amplitude		A Plane (PDL 201)		B Plane (PDL 202)		Criteria	Result
Test speed	min-1	X μm p-p	Y μm p-p	X μm p-p	Y μm p-p	μm p-p	
Maximum continuous speed	10828	12.5	12.1	6.2	4.1	25.0	ACCEPTABLE
Trip speed	11911	17.8	15.0	8.6	2.0	*	ACCEPTABLE

* : As per API

■ Table : Residual unbalance (Reference only data)

Low speed balance	A Plane (Drive end) (PDL 201)				B Plane (Free end) (PDL 202)			
Test speed 1850 min-1	Phase °	Weight g	r 1 mm	Amount g-mm	Phase °	Weight g	r 2 mm	Amount g-mm
Initial unbalance	34	39.4	176.4	6950.2	163	12.6	176.4	2222.6
Final unbalance	5	3.96	176.4	698.5	185	3.34	176.4	589.2

■ Figure: Typical sketches



Thrust collar is

□ A plane side

■ B plane side

Unit : mm

a	515
b	920
c	660
r1	176.4
r2	176.4

Zero phase angle is relative to _____

Reading of phase angle is (■ CW, □ CCW) viewing from (□ thrust, ■ non-thrust) end side.

■ Note Reference item number of quality plan : E04

TO	SET

	Approved (Aero equip. eng. dept.)	Checked (Aero equip. eng. dept.)	Prepared (Aero equip. eng. dept.)	Customer / Inspector
by	H. Ishizawa	—	H. Ishizawa	LGE&C Y. Tsutsumi
Date	July 22th '03		July 22th '03	July 22, 2003

EBARA Corp.

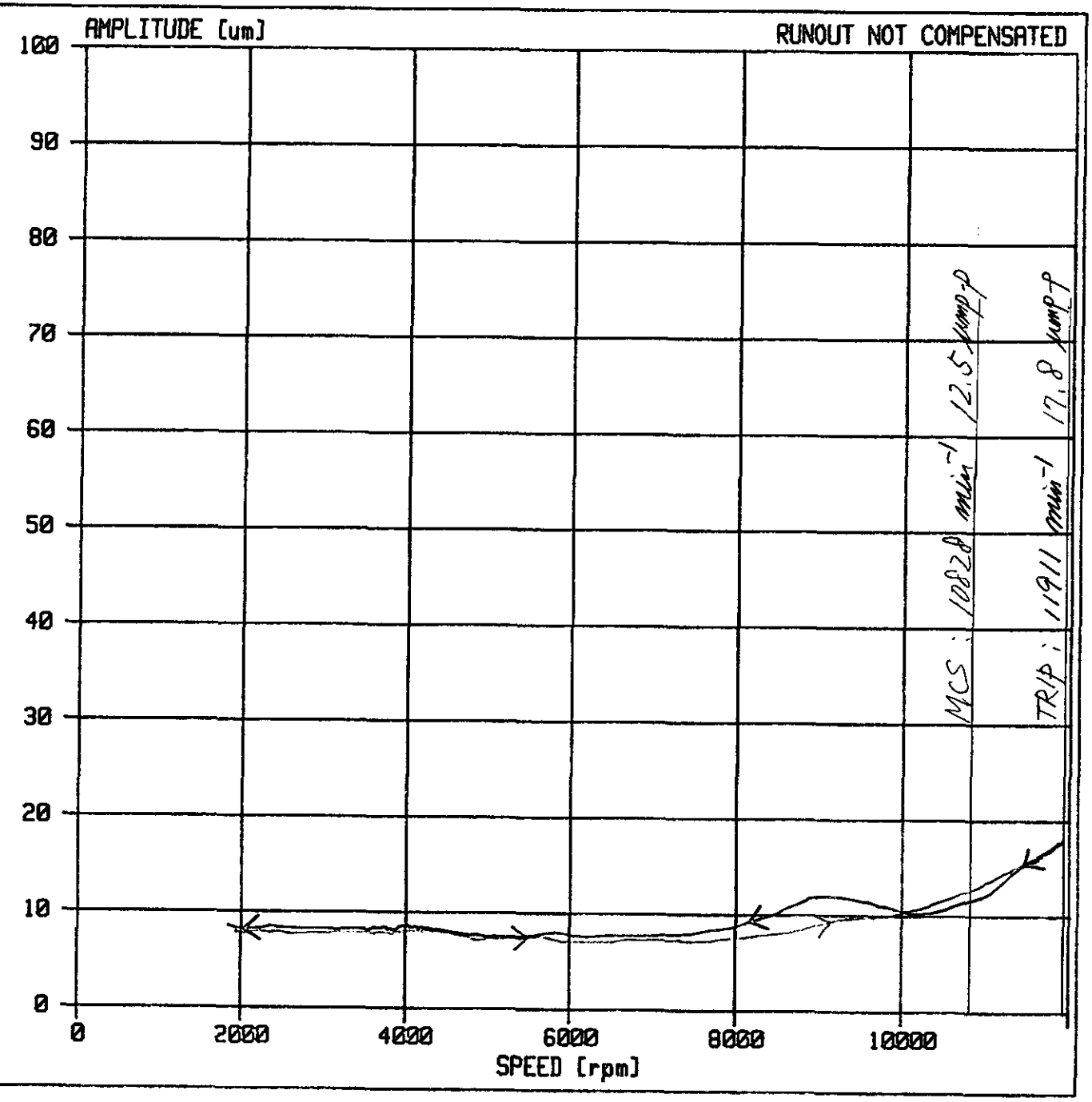
R02157083D

22-07-103 09:51

ACCEL. DECEL.

ROTOR ID.:
JSRV-5DF A rotor

RUN NO.: 9
WITNESS RUN
DEVICE: VC 2000
CHANNEL: 1
PICK UP:
SV
CPLG END PDL201 X



LGE&C
Y. Tsutsumi
July 22, 2003

EBARA Corp.

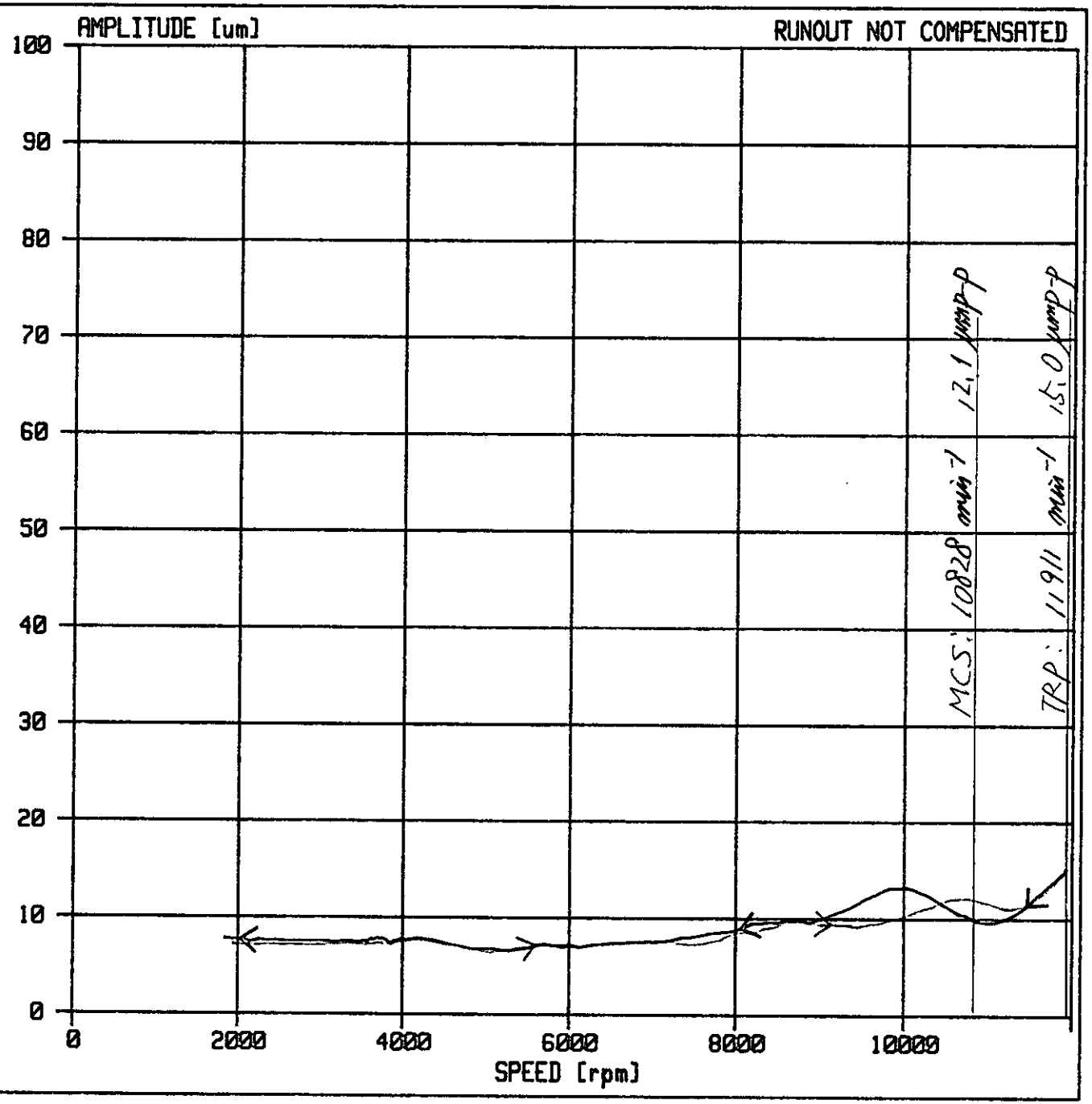
R021570830

22-07-103 09:51

ACCEL. DECEL.

ROTOR ID.:
JSRV-5DF A rotor

RUN NO.: 9
WITNESS RUN
DEVICE: VC 2000
CHANNEL: 2
PICK UP:
SV
CPLG END PDL201 Y



LGE&C
J. Tantsenni
July 22, 2003

EBARA Corp.

R021570830

22-07-103 09:51

ACCEL. DECEL.

ROTOR ID.:
JSRV-5DF A rotor

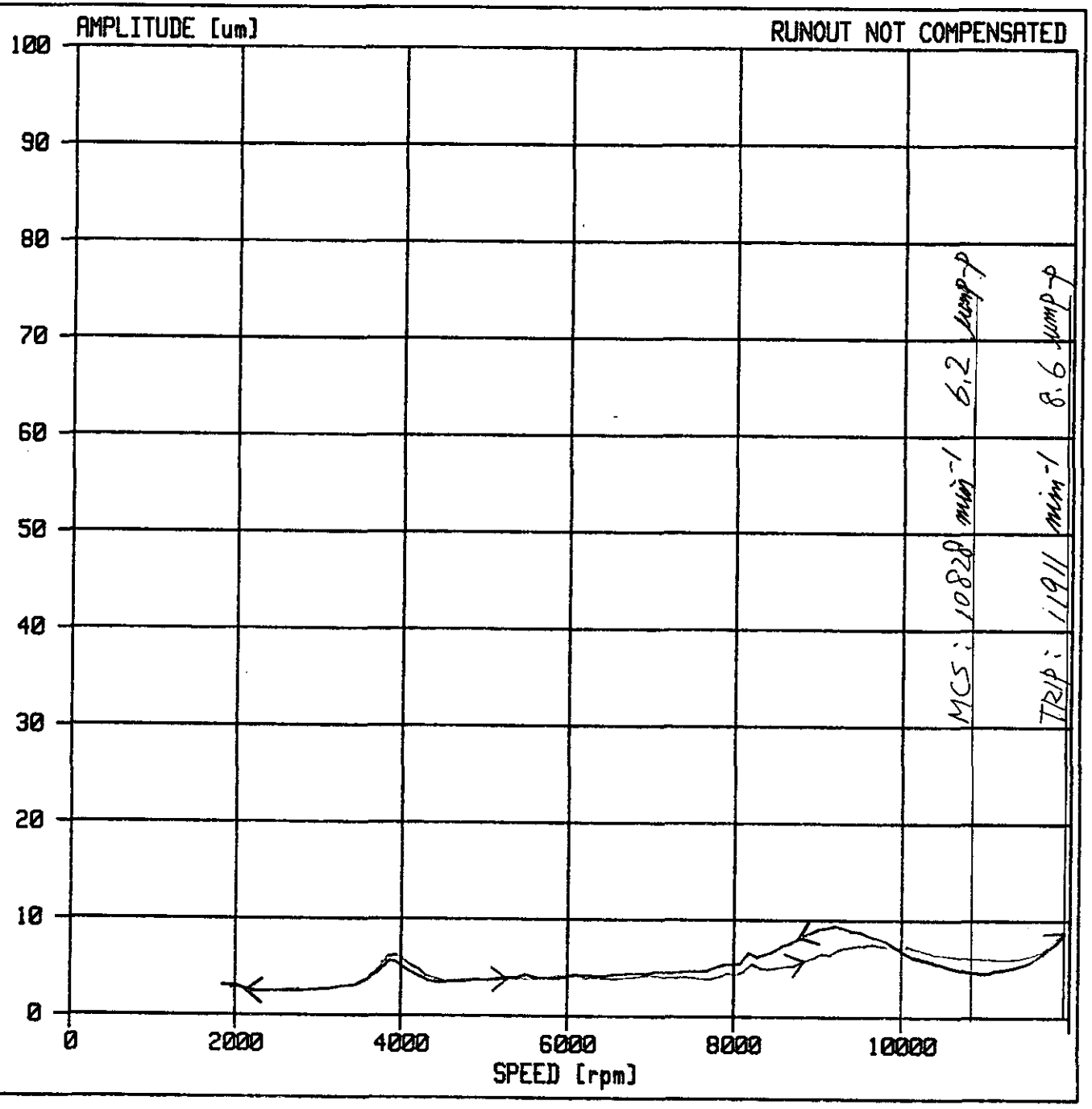
RUN NO.: 9

WITNESS RUN

DEVICE: VC 2000

CHANNEL: 7

PICK UP:
SV
FREE END PDL202 X

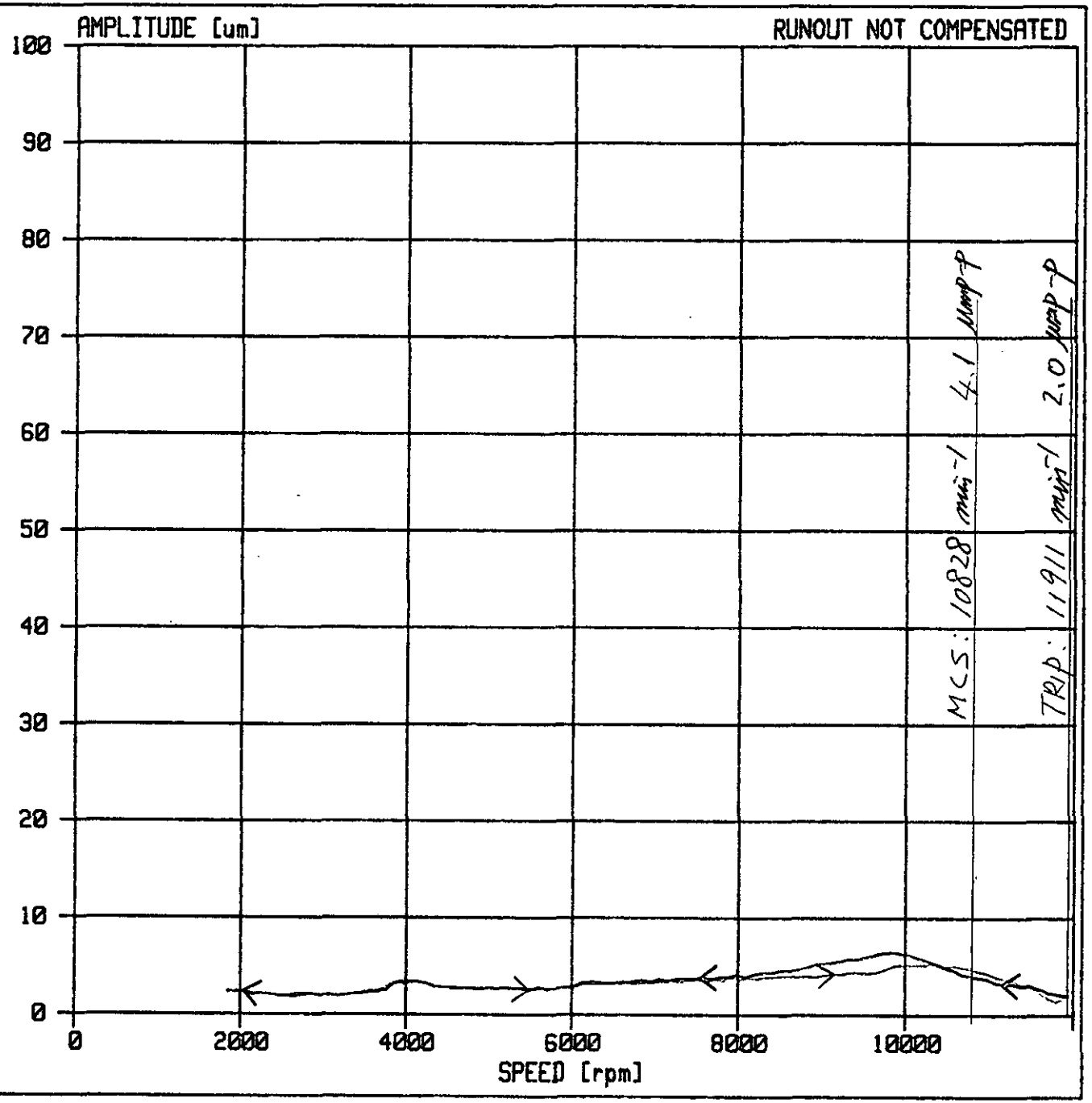


LGE&C
Y. Tsutsumi
July 22, 2003

EBARA Corp.

R02157083D

22-07-103 09:51
ACCEL. DECEL.
ROTOR ID.:
JSRV-5DF A rotor
RUN NO.: 9
WITNESS RUN
DEVICE: VC 2000
CHANNEL: 8
PICK UP:
SV
FREE END PDL202 Y



LGE&C
Y. Tsutsumi
July 22, 2008

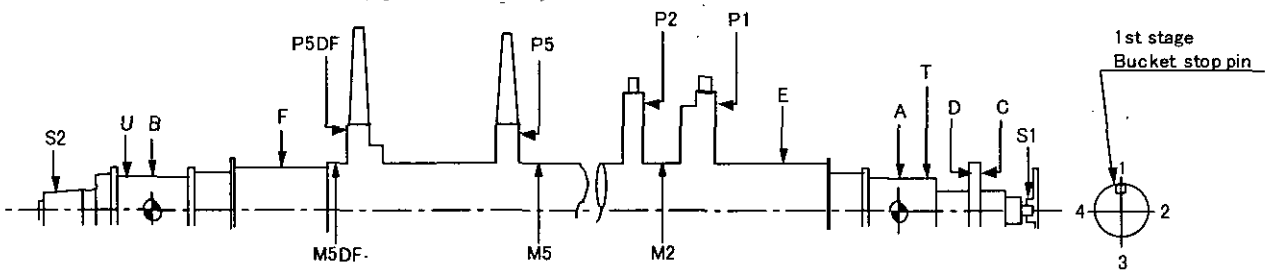
Inspection Activity

Subvendor	Ebara	Customer

P

SUBJECT	STEAM TURBINE ROTOR / MECHANICAL RUNOUT TEST RECORD				
EBARA SER. No.	R021570803	MODEL	SRV-5DF	ITEM No.	CT-9901
MACH. No. –	ROTOR I.D. A				

■ Figure : Typical sketches of main turbine rotor



■ Table : Measured data.

Unit : mm

	Location	Allowance	Point 1	Point 2	Point 3	Point 4	Runout	Result
A	Journal Bearing	0.0127	0	-0.001	-0.001	-0.001	0.001	Acceptable
B	Journal Bearing	0.0127	0	-0.001	-0.001	0	0.001	
C	Thrust Face	0.0127	0	0	-0.001	-0.006	0.006	
D	Thrust Face	0.0127	0	0.001	0.001	0	0.001	
E	Shaft seal surfase	0.025	0	-0.001	-0.005	-0.004	0.005	
F	Shaft seal surfase	0.025	0	-0.010	0.014	0.005	0.014	
M2	Shaft seal surfase	0.025	0	-0.003	-0.004	-0.007	0.007	Acceptable
M3	Shaft seal surfase	0.025	0	0	-0.006	-0.007	0.007	
M4	Shaft seal surfase	0.025	0	0	-0.008	-0.007	0.008	
M5	Shaft seal surfase	0.025	0	0.001	-0.005	-0.007	0.008	
M5DF	Shaft seal surfase	0.025	0	0.003	-0.006	-0.010	0.013	
P1	Disk fase	0.25	0	-0.001	-0.005	-0.007	0.007	Acceptable
P2	Disk fase	0.25	0	0.005	-0.001	-0.002	0.007	
P3	Disk fase	0.25	0	0.003	0.001	-0.003	0.006	
P4	Disk fase	0.25	0	0.004	0.004	-0.003	0.007	
P5	Disk fase	0.25	0	0.002	0.003	0	0.003	
P5DF	Disk fase	0.25	0	-0.002	-0.005	0.001	0.006	
S1	Shaft	0.025	0	0.009	0.017	0.010	0.017	Acceptable
S2	Shaft	0.025	0	-0.004	0.001	-0.001	0.005	
T	Vibration Sensing Area	0.005	0	-0.001	-0.001	0	0.001	
U	Vibration Sensing Area	0.005	0	-0.001	0.001	-0.001	0.002	

LGE&C
J. Tsutsumi
Reviewed on July 22, 2003

■ Note Reference item number of quality plan : E08

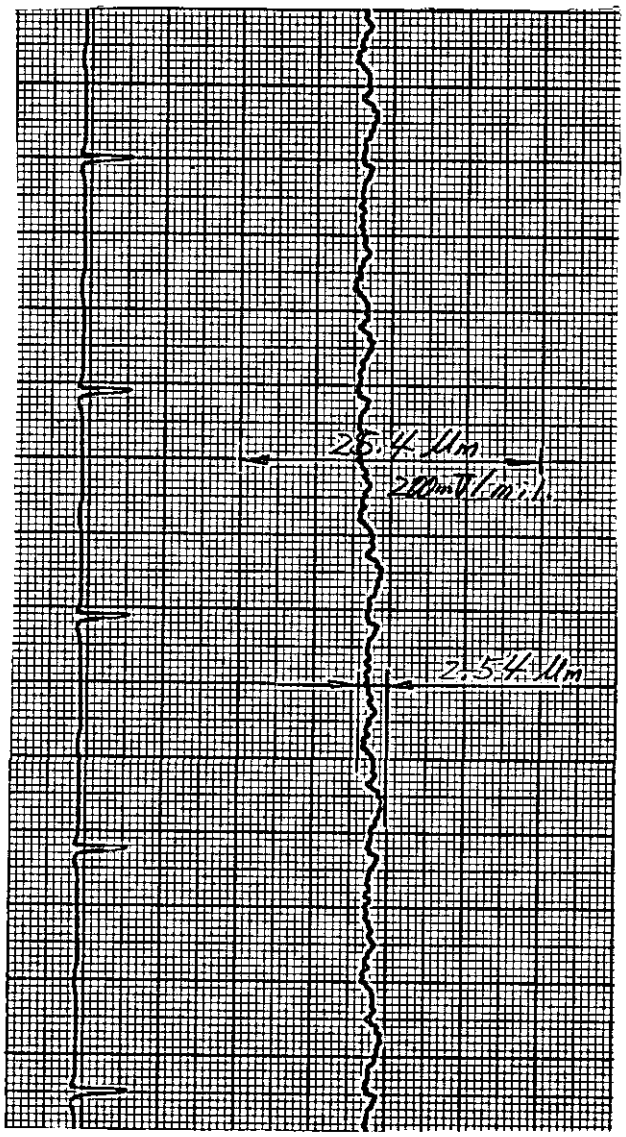
TO	SET

	Approved (QA dept.)	Checked (QA dept.)	Prepared	Customer / Inspector
by			A. Suwa	
Date	Jul.-17'03	Jul.-17-2003	JLY.16.2003	

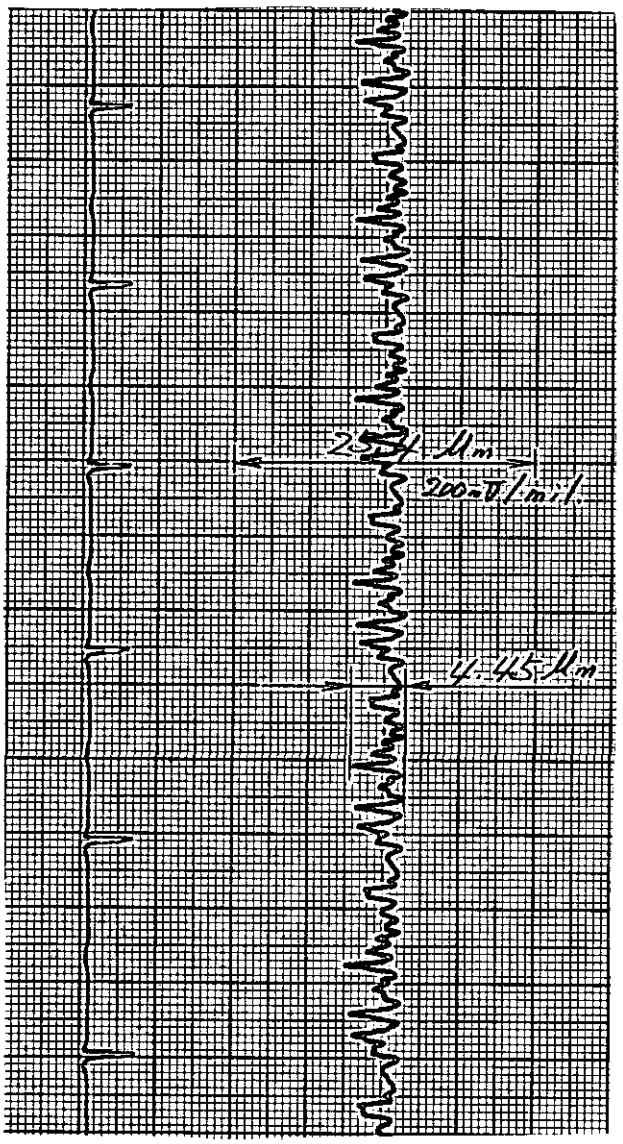
SUBJECT	STEAM TURBINE ROTOR / TOTAL (MECHANICAL & ELECTRICAL) RUN-OUT RECORD (RADIAL)		
EBARA SER. No.	R021570803	MODEL SRV-5DF	ITEM No. CT-9901
MACH. No. –	ROTOR I.D. A		

Vibration probe sensing area

Location ■ Thrust side ☐ Non thrust side
Criteria Max. 6.4 μm
Result ■ Acceptable ☐ Not acceptable



Location ☐ Thrust side ■ Non thrust side
Criteria Max. 6.4 μm
Result ■ Acceptable ☐ Not acceptable



■ Note Reference item number of quality plan : E09

TO	SET

	Approved (QA dept.)	Checked (QA dept.)	Prepared	Customer / Inspector
by			A. Suwa	LGE&C Y. Tsutsumi
Date	Jul. 17 '03	Jul.-17-2003	JLY. 16. 2003	July 22, 2003

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

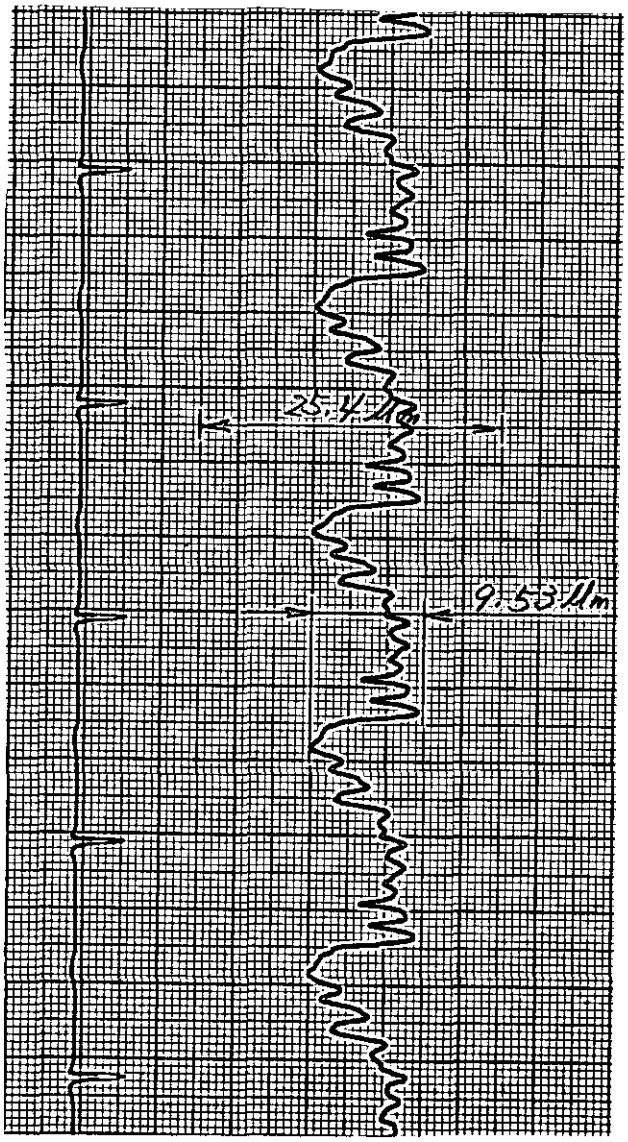
SUBJECT	STEAM TURBINE ROTOR / TOTAL (MECHANICAL & ELECTRICAL) RUN-OUT RECORD (AXIAL)		
EBARA SER. No.	R021570803	MODEL SRV-5DF	ITEM No. CT-9901
MACH. No. –	ROTOR I.D. A		

Axial probe sensing area

Location ☐ Thrust nut ☒ Shaft end

Criteria Max. 12.7 μm

Result ☒ Acceptable ☐ Not acceptable



Location ☐ Thrust nut ☐ Shaft end

Criteria Max. 12.7 μm

Result ☐ Acceptable ☐ Not acceptable

■ Note Reference item number of quality plan : E09

TO	SET

	Approved (QA dept.)	Checked (QA dept.)	Prepared	Customer / Inspector
by			A. Suwa	L&E&C Y. Tsutsumi
Date	Jul.17'03	Jul.-17-2003	JLY. 16. 2003	July 22, 2003

ELLIOTT®
EBARA GROUP

STEAM TURBINE

ITEM NO.	TC-9901		ELLIOTT EBARA S.O.NO.	R021570803	
DATE	NOV. 2003		ELLIOTT S.O.NO.	—	
TYPE	SRV-5DF		MAX. OPERATING CONDITIONS		
RATED OUTPUT	5300	kW	SPEED	10828	min^{-1}
RATED SPEED	9591	min^{-1}	INLET PRESS.	41.0	kgf/cm^2G
INLET PRESS.	38.0	kgf/cm^2G	INLET TEMP.	440	°C
INLET TEMP.	390	°C	EXH. PRESS.	81.0	mmHgA
EXHAUST PRESS.	81.0	mmHgA	FIRST CRITICAL	5997	min^{-1}
EXTRACTION PRESS.	—	kgf/cm^2G	SECOND CRITICAL (CALC.)	18000	min^{-1}
TRIP SPEED (ELEC.)	11911	min^{-1}	SENTINEL VALVE PRESS.	—	kgf/cm^2G
(MECH.)	—	min^{-1}			

Elliott Ebara Turbomachinery Corporation CHIBA, JAPAN

MANUFACTURED IN JAPAN UNDER LICENSE OF ELLIOTT TURBOMACHINERY CO., INC. JEANNETTE, PENNSYLVANIA, U.S.A., BY ELLIOTT EBARA TURBOMACHINERY CORPORATION.

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TITLE	Compressor Performance Test Report	DOC.No. 8214-IT031	REV. 0
CUSTOMER	LG Engineering & Construction Corp.	COMPLETE IN WITH COVER 65	SHEETS
FINAL USER	Turkish Petroleum refineries Corp.		
PROJECT	Tupras Izmir Refinery DHP	SERVICE	Recycle Compressor
JOB No.	7020	EBARA SER.No.	R0215708
ITEM No.	CT-9901/TC-9901	MODEL/EQUIP.	25MB5/SRV-5DF SET 1

Note : The test was conducted with A (Spare) Rotor.

INSPECTION TEAM
☑ WITNESSED ☑ REVIEWED
LG E&C D.Y.KIM/Oct.16.'03

☐ FOR APPROVAL	☐ FOR RECORD
AVOID DELAY TO MAINTAIN SHIPPING PROMISE. ONE APPROVED PRINT MUST BE RETURNED BY: _____ BY: _____ DATE: _____	ANY REQUESTED CHANGE OF THIS EQUIPMENT WILL RESULT IN: 1.CONTRACT PRICE ADJUSTMENT 2.EXTENDED SHIPPING PROMISE AS THIS CONTRACT IS IN MANUFACTURING PROCESS. BY: _____ DATE: _____

TO SET
CUS. 1R

Issued by
Test Engineering Section

APPROVED BY K. Ishikawa Oct 30 '03

CHECKED BY

PREPARED BY N. Ishikawa

REV.	PAGE	DATE	APP'D	BY
5				
4				
3				
2				
1				

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

Contents

S.O. No.	:	R0215708
MODEL	:	25MB5
ITEM NO.	:	CT-9901
ROTOR	:	A Spare

1 General

(1) Test date 30-Sep-03

Place : Sodegaura Plant of Ebara Corporation Japan

(2) Test method : Closed Loop

(3) Test gas : He-N2

(4) Codes or standards applied :
ASME PTC 10-1997
Type 2

(5) Compressor type Variable-speed

(6) Method of measurement

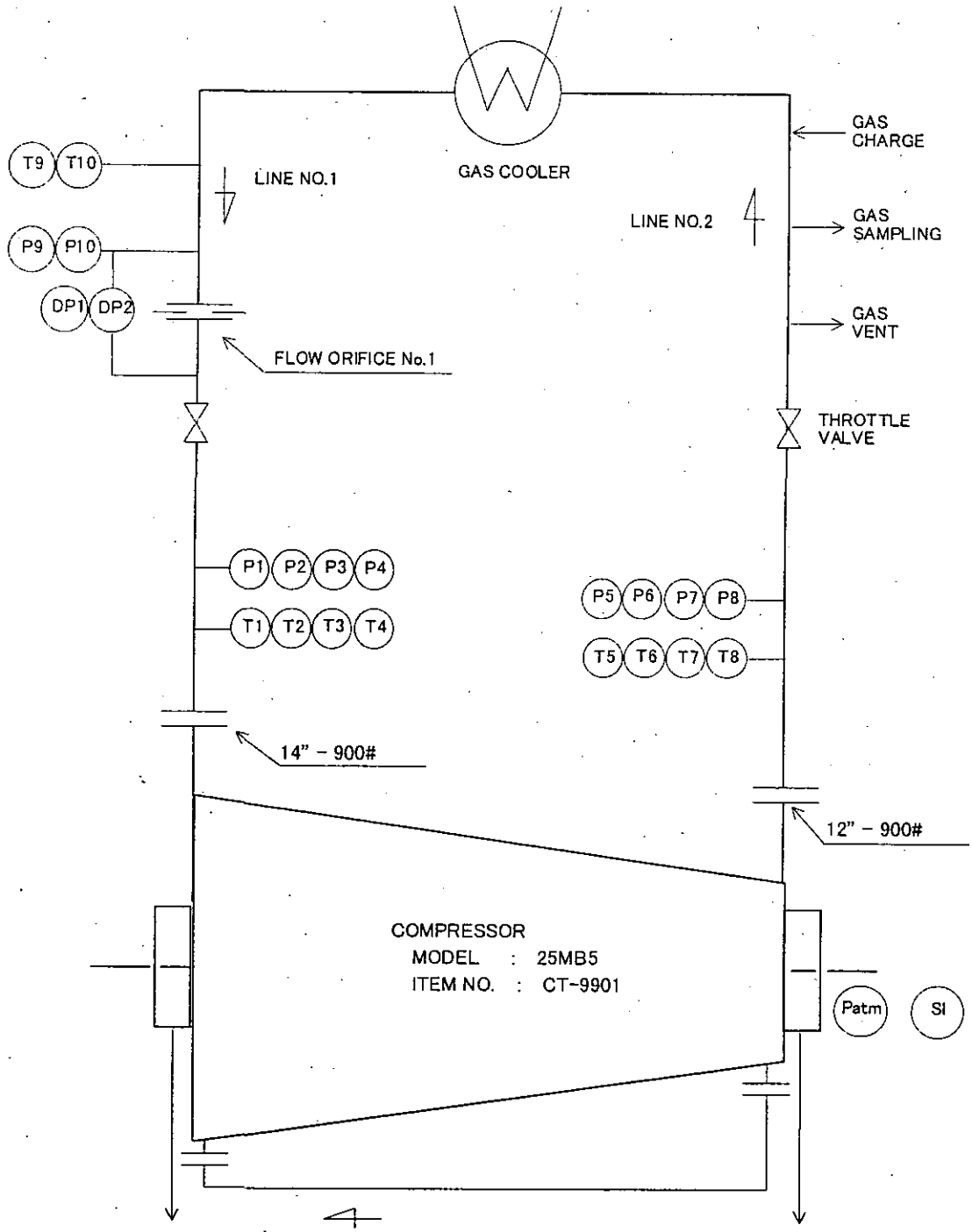
Automatic measuring system is employed in compressor performance testing.
Reading are converted into direct current signal, which then is changed to digital signa to be treated by an electronic computer to obtain final test results.
Test report is based on computer reading.
For further detail, refer to "COMPRESSOR PERFORMANCE TEST PROCEDURE".

INSPECTION TEAM
☐ WITNESSED ☑ REVIEWED
LG E&C

2 Schematic of Gas Loop Piping and Instrumentation

H. Schematic of gas loop piping and instrumentation

S.O.No. R0215708
MODEL 25MB5
ITEM NO. CT-9901

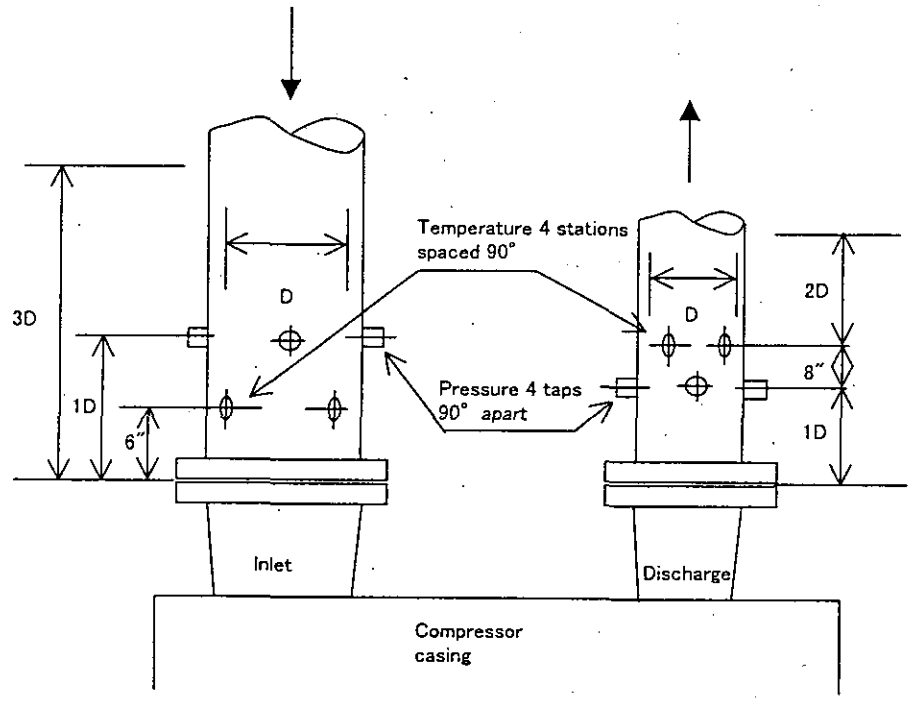


3 Orifice Data and Measuring Arrangemnet

I. INLET AND DISCHARGE PIPE ARRANGEMENT

Instruments shown in Section H will be located at the points shown below.

S.O.No.	R0215708
MODEL	25MB5
ITEM NO.	CT-9901



Inlet Line No.	Pipe Nominal Dia [inch.]	Pipe In. Dia D [mm]	Minimum length L=3xD [mm]
1	14	339.8	1019.4

Disch. Line No.	Pipe Nominal Dia [inch.]	Pipe In. Dia D [mm]	Minimum length L=3xD+8" [mm]
2	12	304.7	1117.3

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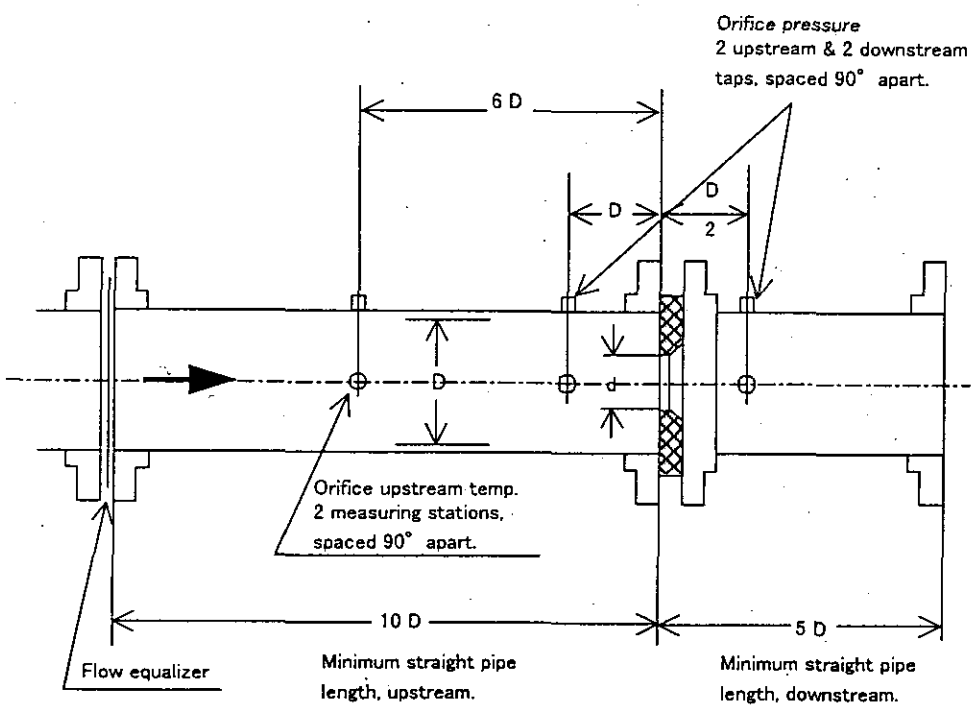
J. FLOW ORIFICE DATA

S.O.No.	R0215708
MODEL	25MB5
ITEM NO.	CT-9901

Orifice No.	Pipe Nominal Dia [inch.]	Pipe In. Dia D [mm]	Orifice Hole d [mm]	Beta d/D
1	10	254.2	148.7	0.585



INSPECTION TEAM
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S.O. No. :	R0215708
MODEL :	25MB5
ITEM NC :	CT-9901
ROTOR :	A Spare

4 Test Results

1 Summary of test result Acceptable

Official test result shows that the compressor meets the specified requirement at the specified operating condition as shown below.

The compressor performance listed below is well within the requirement and criteria.

2 Test results and Criteria

2-1 Accepance criteria Refer to section F of "Performance Test Procedure".

2-2 Summary table of the test results

Guarantee Case Item	Unit	Tested	Specified	Deviation (Test-Spec)/Spec
Speed	rpm	9591.	9591.	0.0%
Inlet pressure	kgf/cm2A	65.4	65.4	0.0%
Inlet flow	m3/hr	6925.	6925.	0.0%
Total head	m	12762.	12762.	0.0%
Discharge pressure	kgf/cm2A	88.8	88.8	0.0%
Shaft power (Incl. mech. loss)	kw	4937.	4818.	2.47% (≦ +4%)

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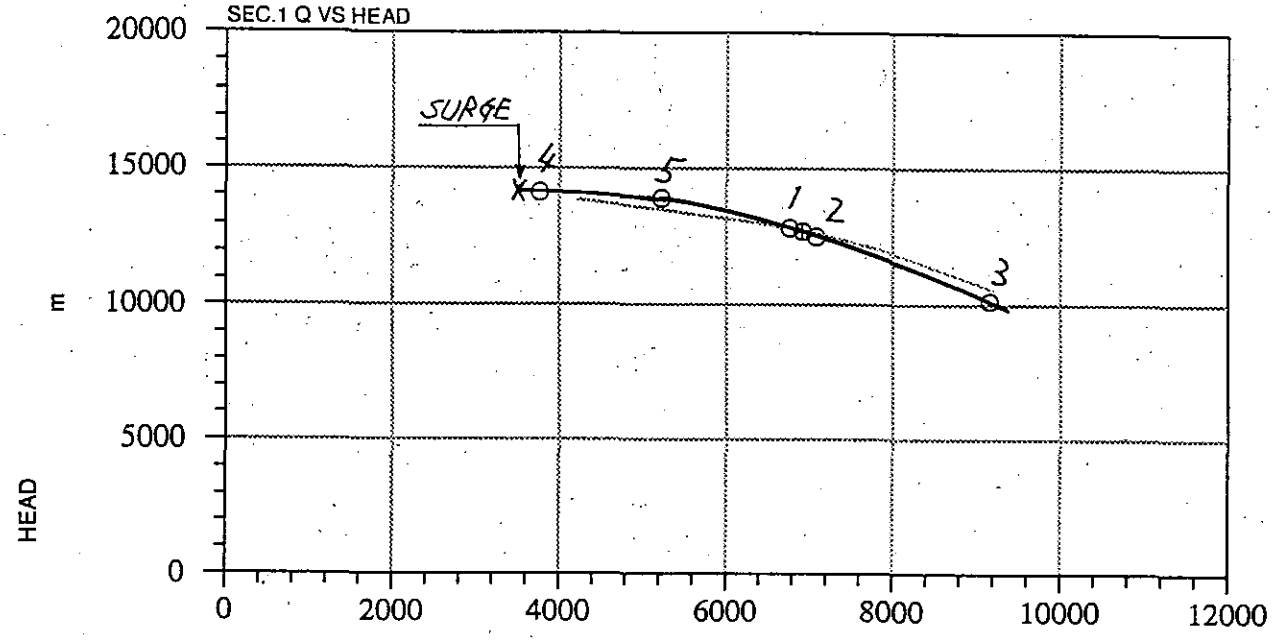
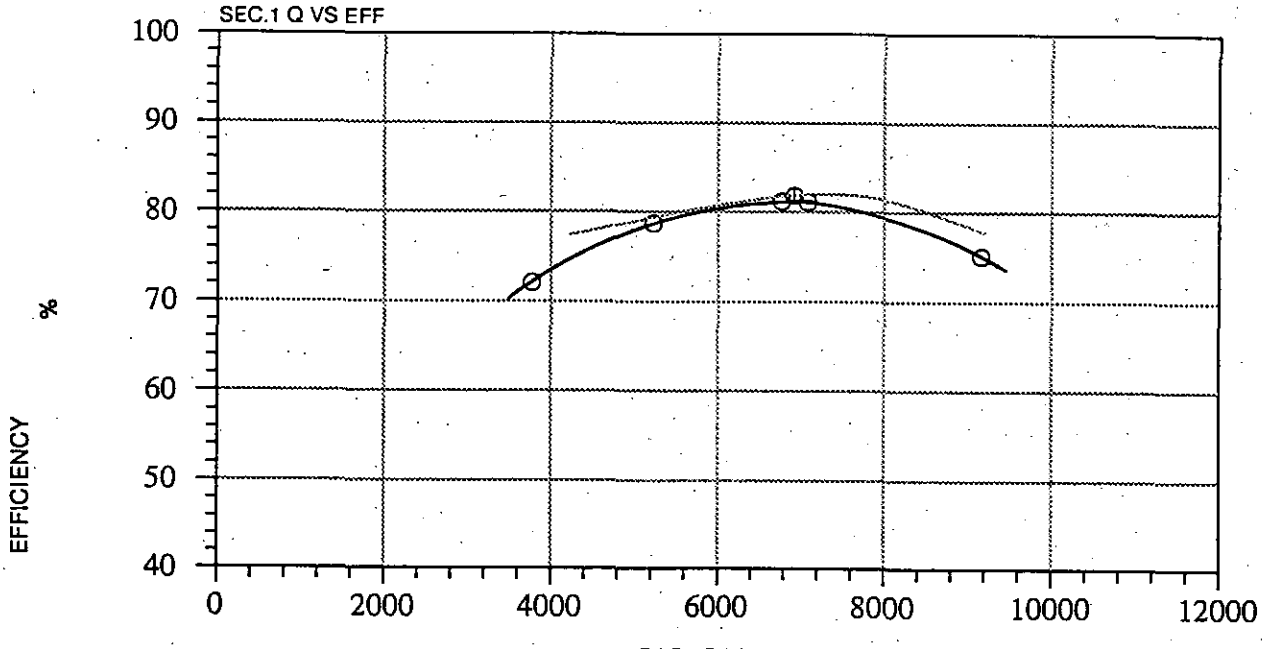
Test Date 30-Sep-03 Test Engineer N. Ishikawa

5 Performance Curve

5. 性 能 カ ー ブ
PERFORMANCE CURVE

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5





INSPECTION TEAM
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LG E&C D.Kim/Sep.30.03

御立会者 WITNESSED BY　　日付 DATE　/ /

審査 TEST ENGINEER　　日付 DATE

N. ISHIKAWA　N. Ishikawa　03/09/30

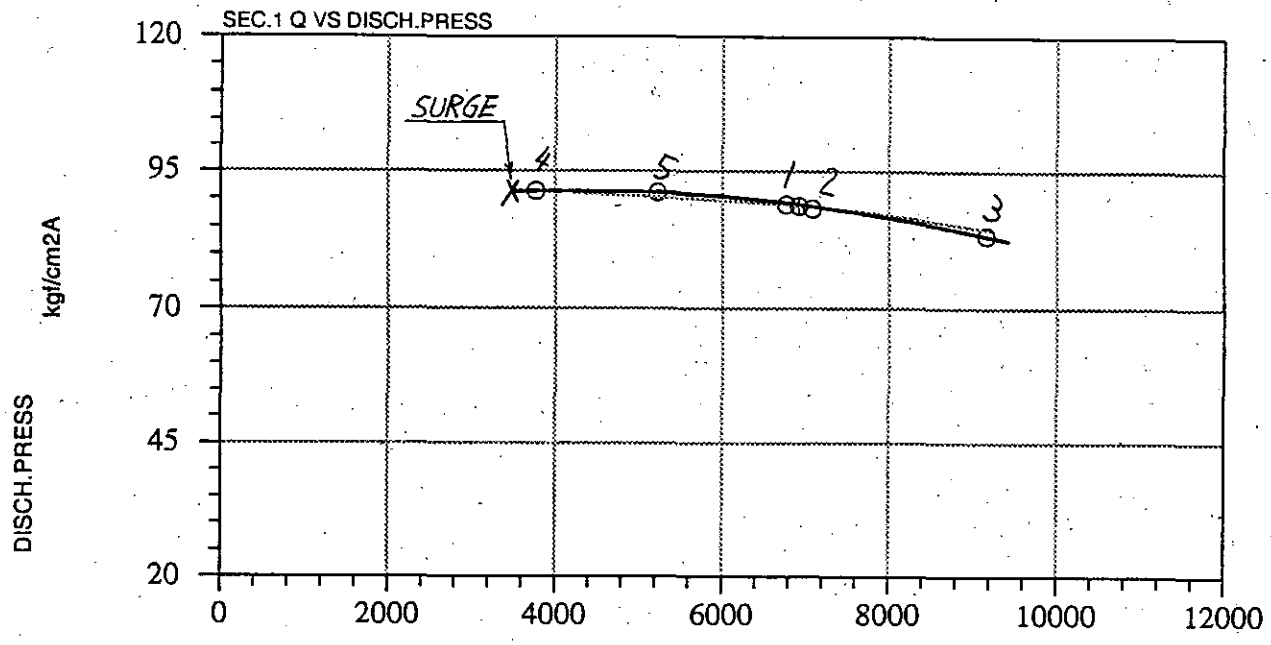
記録 RECORDED BY　　日付 DATE

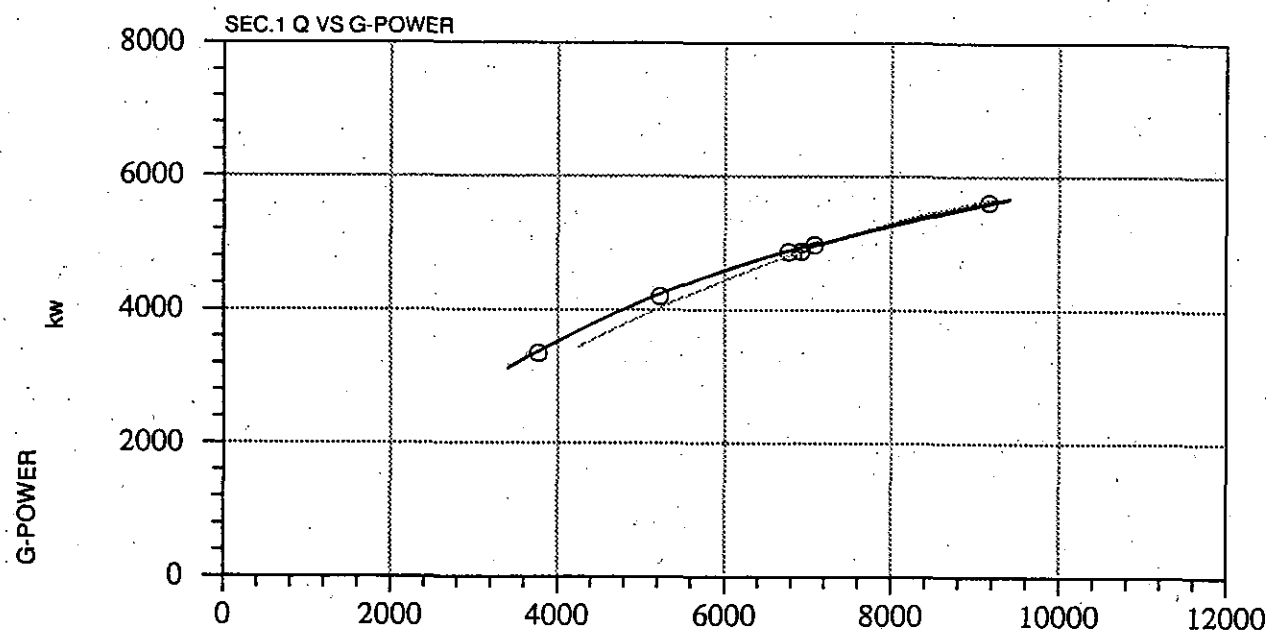
K. HONDO　K. Hondo　03/09/30

5. 性 能 カ ー ブ
PERFORMANCE CURVE

03/ 9/30

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5





CAPACITY m3/h

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/ /

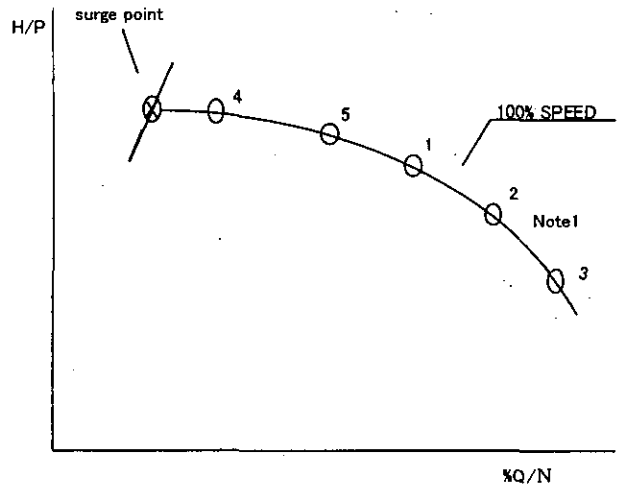
審査 TEST ENGINEER 日付 DATE

N. ISHIKAWA 03/09/30

記録 RECORDED BY 日付 DATE

K. HONDO 03/09/30

6 Performance Data



POINT NO.	LOG NO.	RUN NO.	TIME	Note
1	1	5	14:38	
2	2	5	15:41	
3	3	5	16:42	
Surge	55	57	17:15	
4	4	5	18:05	
5	5	5	18:57	

LG E&C INSPECTION TEAM ☑ WITNESSED ☐ REVIEWED

性能試験結果
PERFORMANCE TEST LOG. (1/4)

オリフィスデータ
ORIFICE DATA 14

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 1　　計測NO. RUN NO. : 5
オリフィスNO. : 1 ORIFICE NO.

計測日時 MES. DATE : 03 / 9 / 30 14 : 38
コメント COMMENT : point 1

パラメータ PARAMETER	上流 圧力 UPSTREAM PRESS.	上流 温度 UPSTREAM TEMP.	差圧 DIFF. PRESS.	大気圧 ATM PRESS.
計測値－1 OBSERVED DATA -1	9.6733 kgf/cm²G	35.86 ℃	0.2664 kgf/cm²	1.0267 kgf/cm²A
計測値－2 OBSERVED DATA -2	9.7428 kgf/cm²G	36.46 ℃	0.2663 kgf/cm²	
誤差 DIFFERENTIAL	0.0695 kgf/cm²G	0.60 ℃	0.0001 kgf/cm²	
平均値 AVERAGE	10.7347 kgf/cm²A 10.7344 10.7315	309.31 K 309.31 309.31	0.2664 kgf/cm² 0.2668 0.2672	1.0267 kgf/cm²A 1.0267 1.0267
誤差率 FLUCTUATION	0.03 %	0.00 %	0.31 %	
最終平均値 FINAL AVE.VALUE	10.7335 kgf/cm²A	309.31 K	0.2668 kgf/cm²	

計算値 CALCULATED VALUE				
	オリフィス通過流量 ORIFICE FLOW RATE	23299.3 kg/hr.	流量係数 FLOW COEFFICIENT	0.643915
	オリフィス上流比容積 UPSTREAM SP VOL.	0.154027 m³/kg	上流ガス粘度 UPSTREAM GAS VISCOSITY	0.0161636 centipoise
	膨張係数 EXPANSION FACTOR	0.992535	熱膨張係数 THERMAL EXPANSION FACTOR	1.00051
	レイノルズ数 UPSTREAM RE NO.	2.00569E+06	温度指数 ISEN TEMP. EXP.	1.50155
	線膨張率 ALPHA	8.9186E-06		

INSPECTION TEAM
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御立会者 WITNESSED BY　　日付 DATE

審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA　　03/09/30

性能試験結果
PERFORMANCE TEST LOG. (2/4)

セクションデータ
SECTION DATA 15

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 1　　計測NO. RUN NO. : 5
セクションNO. SECTION NO. : 1

計測日時 MES. DATE : 03 / 9 / 30 14 : 38
コメント COMMENT : point 1

パラメータ PARAMETER	吸込 圧力 INLET PRESS.	吸込 温度 INLET TEMP.	吐出 圧力 DISCH. PRESS.	吐出 温度 DISCH. TEMP.
計測値－1 OBSERVED DATA - 1	7.2006 kgf/cm²G	35.30 ℃	10.5682 kgf/cm²G	82.60 ℃
計測値－2 OBSERVED DATA - 2	7.1748 kgf/cm²G	35.34 ℃	10.5646 kgf/cm²G	82.25 ℃
計測値－3 OBSERVED DATA - 3	7.1844 kgf/cm²G	35.26 ℃	10.5520 kgf/cm²G	82.20 ℃
計測値－4 OBSERVED DATA - 4	7.1961 kgf/cm²G	35.30 ℃	10.5553 kgf/cm²G	82.43 ℃
誤差 DIFFERENTIAL	0.0257 kgf/cm²G	0.07 ℃	0.0162 kgf/cm²G	0.40 ℃
平均値 AVERAGE	8.2156 kgf/cm²A 8.2163 8.2128	308.45 K 308.44 308.41	11.5867 kgf/cm²A 11.5863 11.5820	355.52 K 355.59 355.53
誤差率 FLUCTUATION	0.04 %	0.01 %	0.04 %	0.02 %
最終平均値 FINAL AVE. VALUE	8.2149 kgf/cm²A	308.43 K	11.5850 kgf/cm²A	355.55 K

パラメータ PARAMETER	回転数 SPEED	大気圧 ATM PRESS.		
計測値－1 OBSERVED DATA - 1	6614 min⁻¹	1.0267 kgf/cm²A		
計測値－2 OBSERVED DATA - 2				
計測値－3 OBSERVED DATA - 3				
計測値－4 OBSERVED DATA - 4				
誤差 DIFFERENTIAL				
平均値 AVERAGE	6614 min⁻¹ 6615 6614	1.0267 kgf/cm² 1.0267 1.0267		
誤差率 FLUCTUATION	0.01 %			
最終平均値 FINAL AVE. VALUE	6615 min⁻¹			

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LG E&C

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審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA　　03/09/30

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

性能試験結果
PERFORMANCE TEST LOG. (3/4)

試験条件 16
TEST CONDITIONS

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 1　　計測NO. RUN NO. : 5

セクションNO. SECTION NO. : 1

計測日時 MES. DATE : 03 / 9 / 30 14 : 38

コメント COMMENT : point 1

計測値 OBSERVED DATA　試験ガス成分 TEST GAS PURITY

49.74 % [N2]
50.26 % [He]
0.00 % [O2]

計算値 CORRECTION DATA　重量流量 FLOW RATE

23299.3 kg/hr.

	パラメーター PARAMETER	計算結果 TEST RESULT	単位 UNIT
吸込 INLET	吸込静比容積 SP. VOL. (STATIC)	0.200436	m^3/kg
	吸込静風量 STATIC CAPACITY	4670.47	$m^3/hr.$
	吸込流速 GAS VELOCITY	14.3038	m/sec
	吸込動圧 VEL. PRESS.	0.0052	kgf/cm^2
	吸込静比熱 SP. HEAT (CP)	0.374921	kcal/kg°C
	吸込動温 VEL. TEMP.	0.07	K
	吸込全圧 STAG. PRESS.	8.2201	kgf/cm^2A
	吸込全温 STAG. TEMP.	308.46	K
	吸込全比容積 SP. VOL. (STAG.)	0.200324	m^3/kg
	吸込全風量 STAG. CAPACITY	4667.87	$m^3/hr.$

	パラメーター PARAMETER	計算結果 TEST RESULT	単位 UNIT
吐出 DISCH.	吐出静比容積 SP. VOL. (STATIC)	0.164104	m^3/kg
	吐出静風量 STATIC CAPACITY	3823.89	$m^3/hr.$
	吐出流速 GAS VELOCITY	14.5705	m/sec
	吐出動圧 VEL. PRESS.	0.0066	kgf/cm^2
	吐出静比熱 SP. HEAT (CP)	0.375283	kcal/kg°C
	吐出動温 VEL. TEMP.	0.07	K
	吐出全圧 STAG. PRESS.	11.5916	kgf/cm^2A
	吐出全温 STAG. TEMP.	355.57	K
	吐出全比容積 SP. VOL. (STAG.)	0.164022	m^3/kg
	吐出全風量 STAG. CAPACITY	3821.98	$m^3/hr.$

パラメーター PARAMETER	計算結果 TEST RESULT	単位 UNIT
流量回転数比 TEST CAPACITY - SPEED RATIO	0.705694	
% Q／N比（キャパシティースピードレシオ） % CAPACITY - SPEED RATIO	97.75	%
比容積比 TEST VOLUME RATIO	1.22132	
% 比容積比 % VOLUME RATIO	99.70	%
羽根周速 TEST PERIPHERAL SPEED	151.177	m/sec
粘度（センチポアズ） TEST INLET GAS VISCOSITY	0.016111	centipoise
動粘度（ストークス） TEST INLET KINETIC VISCOSITY	0.0322768	stokes
テストレイノルズ数 TEST REYNOLDS NUMBER	883356	
% RE比 % REYNOLDS NUMBER RATIO	13.78	%
音速 TEST INLET ACOUSTIC VELOCITY	493.904	m/sec
テストマッハ数比 TEST MACH NUMBER RATIO	0.306085	
% マッハ数 % MACH NUMBER	102.71	%
ポリトロープ効率 TEST POLYTROPIC EFFICIENCY	80.69	%
テストガス馬力 TEST POLYTROPIC GAS POWER	478.845	kW

御立会者 WITNESS　LG E&G　INSPECTION TEAM ☑ WITNESSED ☐ REVIEWED　日付 DATE 03/Sep/03

審査 TEST ENGINEER　日付 DATE

N.ISHIKAWA　N. Ishikawa　03/09/30

性能試験結果
PERFORMANCE TEST LOG. (4/4)

仕様状態への換算 17
CONVERSION TO SPECIFIED CONDITIONS

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 1　　計測NO. RUN NO. : 5
セクションNO. SECTION NO. : 1

計測日時 MES. DATE : 03 / 9 / 30 14 : 38
コメント COMMENT : point 1

性能試験結果 CALCULATION OF TEST RESULT

項目 ITEM	計算結果 CALC. RESULT	単位 UNIT
吸込エンタルピ INLET ENTHALPY	115.097	kcal/kg
吸込エントロピー INLET ENTROPY	1.8449	kcal/kg°C
等エントロピー温度指数 INLET ISEN. TEMP. EXPONENT	1.50133	
吐出温度 ISEN. STATIC DISCH. TEMP.	345.95	K
吐出比容積 ISEN. STATIC DISCH. SP. VOL.	0.159588	m^3/kg
等エントロピー圧縮時吐出エンタルピ ISEN STATIC DISCH. ENTHALPY	129.158	kcal/kg
等エントロピー容積指数 OVERALL ISENTROPIC VOL. EXPONENT	1.51178	
等エントロピーワーク ISENTROPIC WORK	6003.32	m
等エントロピーヘッド ISENTROPIC HEAD	6002.44	m
ワークファクター WORK FACTOR	1.00015	
ポリトロープ指数 OVERALL POLYTROPIC VOL. EXPONENT	1.71903	
吐出エンタルピ DICH. ENTHALPY	132.769	kcal/kg
ガス入力 POWER INPUT TO GAS	17.6717	kcal/kg
ポリトロープヘッド PORYTROPIC HEAD	6087.97	m
ポリトロープワーク PORYTROPIC WORK	386.397	kW
ポリトロープ効率 PORYTROPIC EFFICIENCY	80.6935	%
吸込全風量 INLET STAG. CAPACITY	4667.87	$m^3/hr.$

仕様状態換算 CONVERSION TO SPECIFIED CONDITION

項目 ITEM	計算結果 CALC. RESULT	単位 UNIT
回転数比 SPEED RATIO	1.44998	
比容積比 CONVERTED VOLUME RATIO	1.21532	
換算風量 CONVERTED INLET STAG. CAPACITY	6768.31	$m^3/hr.$
換算重量流量 CONVERTED INLET FLOW RATE	112794	kg/hr.
換算ヘッド CONVERTED POLYTROPIC HEAD	12880.1	m
換算効率 CONVERTED POLYTROPIC EFFICIENCY	81.2015	%
換算吐出圧 CONVERTED DISCHARGE PRESS.	89.0321	kgf/cm^2A
換算吐出温度 CONVERTED DISCHARGE TEMP.	87.08	℃
換算ガス馬力 CONVERTED GAS POWER	4873.73	kW

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ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

性能試験結果
PERFORMANCE TEST LOG. (1/4)

オリフィスデータ
ORIFICE DATA

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 2　　計測NO. RUN NO. : 5　　計測日時 MES. DATE : 03 / 9 / 30 15 : 41

オリフィスNO. ORIFICE NO. : 1　　コメント COMMENT : point 2

パラメータ PARAMETER	上流 圧力 UPSTREAM PRESS.	上流 温度 UPSTREAM TEMP.	差圧 DIFF. PRESS.	大気圧 ATM PRESS.
計測値－1 OBSERVED DATA -1	9.8763 kgf/cm²G	36.34 ℃	0.2868 kgf/cm²	1.0269 kgf/cm²A
計測値－2 OBSERVED DATA -2	9.9490 kgf/cm²G	36.77 ℃	0.2870 kgf/cm²	
誤差 DIFFERENTIAL	0.0727 kgf/cm²G	0.44 ℃	0.0002 kgf/cm²	
平均値 AVERAGE	10.9395 kgf/cm²A 10.9401 10.9255	309.71 K 309.66 309.46	0.2869 kgf/cm² 0.2874 0.2859	1.0269 kgf/cm²A 1.0267 1.0265
誤差率 FLUCTUATION	0.13 %	0.08 %	0.52 %	
最終平均値 FINAL AVE.VALUE	10.9351 kgf/cm²A	309.61 K	0.2867 kgf/cm²	

計算値 CALCULATED VALUE				
	オリフィス通過流量 ORIFICE FLOW RATE	24357.5 kg/hr.	流量係数 FLOW COEFFICIENT	0.643889
	オリフィス上流比容積 UPSTREAM SP VOL.	0.151323 m³/kg	上流ガス粘度 UPSTREAM GAS VISCOSITY	0.0161761 centipoise
	膨張係数 EXPANSION FACTOR	0.992125	熱膨張係数 THERMAL EXPANSION FACTOR	1.00052
	レイノルズ数 UPSTREAM RE NO.	2.09517E+06	温度指数 ISEN TEMP. EXP.	1.50154
	線膨張率 ALPHA	8.9186E-06		

INSPECTION TEAM
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LG E&C

御立会者 WITNESSED BY　　日付 DATE

審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA　　03/09/30

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

性能試験結果
PERFORMANCE TEST LOG. (2/4)

セクションデータ SECTION DATA 19

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 2　　計測NO. RUN NO. : 5　　計測日時 MES. DATE : 03 / 9 / 30 15 : 41

セクションNO. SECTION NO. : 1　　コメント COMMENT : point 2

パラメータ PARAMETER	吸込 圧力 INLET PRESS.	吸込 温度 INLET TEMP.	吐出 圧力 DISCH. PRESS.	吐出 温度 DISCH. TEMP.
計測値－1 OBSERVED DATA - 1	7.1992 kgf/cm²G	35.60 ℃	10.4680 kgf/cm²G	81.91 ℃
計測値－2 OBSERVED DATA - 2	7.1723 kgf/cm²G	35.64 ℃	10.4646 kgf/cm²G	81.48 ℃
計測値－3 OBSERVED DATA - 3	7.1822 kgf/cm²G	35.60 ℃	10.4527 kgf/cm²G	81.41 ℃
計測値－4 OBSERVED DATA - 4	7.1942 kgf/cm²G	35.60 ℃	10.4560 kgf/cm²G	81.68 ℃
誤差 DIFFERENTIAL	0.0269 kgf/cm²G	0.04 ℃	0.0153 kgf/cm²G	0.50 ℃
平均値 AVERAGE	8.2138 kgf/cm²A 8.2129 8.2020	308.76 K 308.70 308.48	11.4872 kgf/cm²A 11.4889 11.4734	354.77 K 354.74 354.45
誤差率 FLUCTUATION	0.14 %	0.09 %	0.13 %	0.09 %
最終平均値 FINAL AVE. VALUE	8.2096 kgf/cm²A	308.65 K	11.4832 kgf/cm²A	354.65 K

パラメータ PARAMETER	回転数 SPEED	大気圧 ATM PRESS.		
計測値－1 OBSERVED DATA - 1	6615 min⁻¹	1.0269 kgf/cm²A		
計測値－2 OBSERVED DATA - 2				
計測値－3 OBSERVED DATA - 3				
計測値－4 OBSERVED DATA - 4				
誤差 DIFFERENTIAL				
平均値 AVERAGE	6615 min⁻¹ 6614 6615	1.0269 kgf/cm² 1.0267 1.0265		
誤差率 FLUCTUATION	0.01 %			
最終平均値 FINAL AVE. VALUE	6615 min⁻¹			

INSPECTION TEAM ☑ WITNESSED ☐ REVIEWED

LG E&C

御立会者 WITNESSED BY　　日付 DATE

審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA　　03/09/30

性能試験結果
PERFORMANCE TEST LOG. (3/4)

試験条件 20
TEST CONDITIONS

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 2　　計測NO. RUN NO. : 5

セクションNO. SECTION NO. : 1

計測日時 MES. DATE : 03 / 9 / 30 15 : 41

コメント COMMENT : point 2

計測値 OBSERVED DATA　試験ガス成分 TEST GAS PURITY

49.75 % [N2]
50.25 % [He]
0.00 % [O2]

計算値 CORRECTION DATA　重量流量 FLOW RATE

24357.5 kg/hr.

	パラメーター PARAMETER	計算結果 TEST RESULT	単位 UNIT
吸込 INLET	吸込静比容積 SP. VOL. (STATIC)	0.200674	m^3/kg
	吸込静風量 STATIC CAPACITY	4888.4	$m^3/hr.$
	吸込流速 GAS VELOCITY	14.9712	m/sec
	吸込動圧 VEL. PRESS.	0.0057	kgf/cm^2
	吸込静比熱 SP. HEAT (CP)	0.374876	kcal/kg°C
	吸込動温 VEL. TEMP.	0.07	K
	吸込全圧 STAG. PRESS.	8.2153	kgf/cm^2A
	吸込全温 STAG. TEMP.	308.67	K
	吸込全比容積 SP. VOL. (STAG.)	0.200552	m^3/kg
	吸込全風量 STAG. CAPACITY	4885.42	$m^3/hr.$

	パラメーター PARAMETER	計算結果 TEST RESULT	単位 UNIT
吐出 DISCH.	吐出静比容積 SP. VOL. (STATIC)	0.165111	m^3/kg
	吐出静風量 STATIC CAPACITY	4022.09	$m^3/hr.$
	吐出流速 GAS VELOCITY	15.3257	m/sec
	吐出動圧 VEL. PRESS.	0.0073	kgf/cm^2
	吐出静比熱 SP. HEAT (CP)	0.375226	kcal/kg°C
	吐出動温 VEL. TEMP.	0.07	K
	吐出全圧 STAG. PRESS.	11.4904	kgf/cm^2A
	吐出全温 STAG. TEMP.	354.68	K
	吐出全比容積 SP. VOL. (STAG.)	0.16502	m^3/kg
	吐出全風量 STAG. CAPACITY	4019.86	$m^3/hr.$

パラメーター PARAMETER	計算結果 TEST RESULT	単位 UNIT
流量回転数比 TEST CAPACITY - SPEED RATIO	0.738568	
% Q／N比（キャパシティースピードレシオ） % CAPACITY - SPEED RATIO	102.31	%
比容積比 TEST VOLUME RATIO	1.21532	
% 比容積比 % VOLUME RATIO	99.21	%
羽根周速 TEST PERIPHERAL SPEED	151.18	m/sec
粘度（センチポアズ） TEST INLET GAS VISCOSITY	0.0161189	centipoise
動粘度（ストークス） TEST INLET KINETIC VISCOSITY	0.0323292	stokes
テストレイノルズ数 TEST REYNOLDS NUMBER	881941	
% RE比 % REYNOLDS NUMBER RATIO	13.76	%
音速 TEST INLET ACOUSTIC VELOCITY	494.031	m/sec
テストマッハ数比 TEST MACH NUMBER RATIO	0.306012	
% マッハ数 % MACH NUMBER	102.69	%
ポリトロープ効率 TEST POLYTROPIC EFFICIENCY	80.62	%
テストガス馬力 TEST POLYTROPIC GAS POWER	488.782	kW

御立会者 WITNESSED BY　LG E&C　INSPECTION TEAM ☑ WITNESSED ☐ REVIEWED　日付 DATE 03/Sep/2003

審査 TEST ENGINEER　N.ISHIKAWA　日付 DATE 03/09/30

性能試験結果
PERFORMANCE TEST LOG. (4/4)

仕様状態への換算 21
CONVERSION TO SPECIFIED CONDITIONS

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 2　　計測NO. RUN NO. : 5

セクションNO. SECTION NO. : 1

計測日時 MES. DATE : 03 / 9 / 30 15 : 41

コメント COMMENT : point 2

性能試験結果 CALCULATION OF TEST RESULT

項目 ITEM	計算結果 CALC. RESULT	単位 UNIT
吸込エンタルピ INLET ENTHALPY	115.164	kcal/kg
吸込エントロピー INLET ENTROPY	1.84503	kcal/kg℃
等エントロピー温度指数 INLET ISEN. TEMP. EXPONENT	1.5013	
吐出温度 ISEN. STATIC DISCH. TEMP.	345.26	K
吐出比容積 ISEN. STATIC DISCH. SP. VOL.	0.160641	m^3/kg
等エントロピー圧縮時吐出エンタルピ ISEN STATIC DISCH. ENTHALPY	128.885	kcal/kg
等エントロピー容積指数 OVERALL ISENTROPIC VOL. EXPONENT	1.51204	
等エントロピーワーク ISENTROPIC WORK	5858.11	m
等エントロピーヘッド ISENTROPIC HEAD	5854.72	m
ワークファクター WORK FACTOR	1.00058	
ポリトロープ指数 OVERALL POLYTROPIC VOL. EXPONENT	1.72054	
吐出エンタルピ DICH. ENTHALPY	132.419	kcal/kg
ガス入力 POWER INPUT TO GAS	17.2547	kcal/kg
ポリトロープヘッド PORYTROPIC HEAD	5939.1	m
ポリトロープワーク PORYTROPIC WORK	394.068	kW
ポリトロープ効率 PORYTROPIC EFFICIENCY	80.6225	%
吸込全風量 INLET STAG. CAPACITY	4885.42	$m^3/hr.$

仕様状態換算 CONVERSION TO SPECIFIED CONDITION

項目 ITEM	計算結果 CALC. RESULT	単位 UNIT
回転数比 SPEED RATIO	1.44995	
比容積比 CONVERTED VOLUME RATIO	1.20953	
換算風量 CONVERTED INLET STAG. CAPACITY	7083.61	$m^3/hr.$
換算重量流量 CONVERTED INLET FLOW RATE	118049	kg/hr.
換算ヘッド CONVERTED POLYTROPIC HEAD	12565.2	m
換算効率 CONVERTED POLYTROPIC EFFICIENCY	81.1331	%
換算吐出圧 CONVERTED DISCHARGE PRESS.	88.3951	kgf/cm^2A
換算吐出温度 CONVERTED DISCHARGE TEMP.	86.34	℃
換算ガス馬力 CONVERTED GAS POWER	4980.24	kW

INSPECTION TEAM
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LG E&C

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審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA　　03/09/30

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

性能試験結果
PERFORMANCE TEST LOG. (1/4)

オリフィスデータ
ORIFICE DATA 22

顧客名 CUSTOMER	アイテムNo. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 3　　計測NO. RUN NO. : 5　　計測日時 MES. DATE : 03 / 9 / 30 16 : 42

オリフィスNO. ORIFICE NO. : 1　　コメント COMMENT : point 3

パラメータ PARAMETER	上流 圧力 UPSTREAM PRESS.	上流 温度 UPSTREAM TEMP.	差圧 DIFF. PRESS.	大気圧 ATM PRESS.
計測値－1 OBSERVED DATA -1	9.6116 kgf/cm²G	35.90 ℃	0.5482 kgf/cm²	1.0277 kgf/cm²A
計測値－2 OBSERVED DATA -2	9.6876 kgf/cm²G	36.20 ℃	0.5494 kgf/cm²	
誤差 DIFFERENTIAL	0.0760 kgf/cm²G	0.30 ℃	0.0012 kgf/cm²	
平均値 AVERAGE	10.6772 kgf/cm²A	309.20 K	0.5488 kgf/cm²	1.0277 kgf/cm²A
	10.6794	309.32	0.5466	1.0276
	10.6771	309.20	0.5462	1.0275
誤差率 FLUCTUATION	0.02 %	0.04 %	0.47 %	
最終平均値 FINAL AVE.VALUE	10.6779 kgf/cm²A	309.24 K	0.5472 kgf/cm²	

計算値 CALCULATED VALUE				
	オリフィス通過流量 ORIFICE FLOW RATE	33000.7 kg/hr.	流量係数 FLOW COEFFICIENT	0.643726
	オリフィス上流比容積 UPSTREAM SP VOL.	0.154883 m³/kg	上流ガス粘度 UPSTREAM GAS VISCOSITY	0.016158 centipoise
	膨張係数 EXPANSION FACTOR	0.984609	熱膨張係数 THERMAL EXPANSION FACTOR	1.00051
	レイノルズ数 UPSTREAM RE NO.	2.8418E+06	温度指数 ISEN TEMP. EXP.	1.50164
	線膨張率 ALPHA	8.9186E-06		

INSPECTION TEAM
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御立会者 WITNESSED BY　　日付 DATE

審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA　　03/09/30

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

性能試験結果

PERFORMANCE TEST LOG. (2/4)

セクションデータ SECTION DATA 23

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 3　　計測NO. RUN NO. : 5

セクションNO. SECTION NO. : 1

計測日時 MES. DATE : 03 / 9 / 30 16 : 42

コメント COMMENT : point 3

パラメータ PARAMETER	吸込 圧力 INLET PRESS.	吸込 温度 INLET TEMP.	吐出 圧力 DISCH. PRESS.	吐出 温度 DISCH. TEMP.
計測値－1 OBSERVED DATA - 1	7.5807 kgf/cm²G	35.22 ℃	10.2698 kgf/cm²G	75.75 ℃
計測値－2 OBSERVED DATA - 2	7.5537 kgf/cm²G	35.40 ℃	10.2682 kgf/cm²G	75.38 ℃
計測値－3 OBSERVED DATA - 3	7.5640 kgf/cm²G	35.20 ℃	10.2534 kgf/cm²G	75.20 ℃
計測値－4 OBSERVED DATA - 4	7.5766 kgf/cm²G	35.26 ℃	10.2596 kgf/cm²G	75.50 ℃
誤差 DIFFERENTIAL	0.0270 kgf/cm²G	0.20 ℃	0.0164 kgf/cm²G	0.55 ℃
平均値 AVERAGE	8.5964 kgf/cm²A 8.5964 8.5968	308.42 K 308.56 308.44	11.2904 kgf/cm²A 11.2922 11.2939	348.61 K 348.62 348.52
誤差率 FLUCTUATION	0.01 %	0.04 %	0.03 %	0.03 %
最終平均値 FINAL AVE. VALUE	8.5965 kgf/cm²A	308.47 K	11.2922 kgf/cm²A	348.58 K

パラメータ PARAMETER	回転数 SPEED	大気圧 ATM PRESS.		
計測値－1 OBSERVED DATA - 1	6615 min⁻¹	1.0277 kgf/cm²A		
計測値－2 OBSERVED DATA - 2				
計測値－3 OBSERVED DATA - 3				
計測値－4 OBSERVED DATA - 4				
誤差 DIFFERENTIAL				
平均値 AVERAGE	6615 min⁻¹ 6615 6615	1.0277 kgf/cm² 1.0276 1.0275		
誤差率 FLUCTUATION	0.00 %			
最終平均値 FINAL AVE. VALUE	6615 min⁻¹			

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審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA　　03/09/30

性能試験結果
PERFORMANCE TEST LOG. (3/4)

試験条件24
TEST CONDITIONS

顧客名 CUSTOMER	アイテムNo. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 3　　計測NO. RUN NO. : 5　　計測日時 MES. DATE : 03 / 9 / 30 16 : 42

セクションNO. SECTION NO. : 1　　コメント COMMENT : point 3

計測値 OBSERVED DATA	試験ガス成分 TEST GAS PURITY	49.70 %	[N2]
		50.30 %	[He]
		0.00 %	[O2]
計算値 CORRECTION DATA	重量流量 FLOW RATE	93000.7 kg/hr.	

	パラメーター PARAMETER	計算結果 TEST RESULT	単位 UNIT
吸込 INLET	吸込静比容積 SP. VOL. (STATIC)	0.191715	m^3/kg
	吸込静風量 STATIC CAPACITY	6327.35	$m^3/hr.$
	吸込流速 GAS VELOCITY	19.3781	m/sec
	吸込動圧 VEL. PRESS.	0.0100	kgf/cm^2
	吸込静比熱 SP. HEAT (CP)	0.375158	kcal/kg°C
	吸込動温 VEL. TEMP.	0.12	K
	吸込全圧 STAG. PRESS.	8.6065	kgf/cm^2A
	吸込全温 STAG. TEMP.	308.52	K
	吸込全比容積 SP. VOL. (STAG.)	0.19152	m^3/kg
	吸込全風量 STAG. CAPACITY	6320.9	$m^3/hr.$

	パラメーター PARAMETER	計算結果 TEST RESULT	単位 UNIT
吐出 DISCH.	吐出静比容積 SP. VOL. (STATIC)	0.165141	m^3/kg
	吐出静風量 STATIC CAPACITY	5450.29	$m^3/hr.$
	吐出流速 GAS VELOCITY	20.7677	m/sec
	吐出動圧 VEL. PRESS.	0.0133	kgf/cm^2
	吐出静比熱 SP. HEAT (CP)	0.375414	kcal/kg°C
	吐出動温 VEL. TEMP.	0.14	K
	吐出全圧 STAG. PRESS.	11.3055	kgf/cm^2A
	吐出全温 STAG. TEMP.	348.63	K
	吐出全比容積 SP. VOL. (STAG.)	0.16497	m^3/kg
	吐出全風量 STAG. CAPACITY	5444.65	$m^3/hr.$

パラメーター PARAMETER	計算結果 TEST RESULT	単位 UNIT
流量回転数比 TEST CAPACITY - SPEED RATIO	0.955582	
% Q／N比（キャパシティースピードレシオ） % CAPACITY - SPEED RATIO	132.37	%
比容積比 TEST VOLUME RATIO	1.16094	
% 比容積比 % VOLUME RATIO	94.77	%
羽根周速 TEST PERIPHERAL SPEED	151.18	m/sec
粘度（センチポアズ） TEST INLET GAS VISCOSITY	0.016114	centipoise
動粘度（ストークス） TEST INLET KINETIC VISCOSITY	0.030864	stokes
テストレイノルズ数 TEST REYNOLDS NUMBER	923810	
% RE比 % REYNOLDS NUMBER RATIO	14.41	%
音速 TEST INLET ACOUSTIC VELOCITY	494.243	m/sec
テストマッハ数比 TEST MACH NUMBER RATIO	0.305881	
% マッハ数 % MACH NUMBER	102.64	%
ポリトロープ効率 TEST POLYTROPIC EFFICIENCY	74.52	%
テストガス馬力 TEST POLYTROPIC GAS POWER	577.679	kW

御立会者 WITNESSED　　INSPECTION TEAM ☑ WITNESSED ☐ REVIEWED　　日付 DATE

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審査 TEST ENGINEER　　日付 DATE

N. ISHIKAWA　　03/09/30

性能試験結果
PERFORMANCE TEST LOG. (4/4)

仕様状態への換算 25
CONVERSION TO SPECIFIED CONDITIONS

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 3　　計測NO. RUN NO. : 5　　計測日時 MES. DATE : 03 / 9 / 30 16 : 42

セクションNO. SECTION NO. : 1　　コメント COMMENT : point 3

性能試験結果 CALCULATION OF TEST RESULT

項目 ITEM	計算結果 CALC. RESULT	単位 UNIT
吸込エンタルピ INLET ENTHALPY	115.173	kcal/kg
吸込エントロピー INLET ENTROPY	1.84002	kcal/kg°C
等エントロピー温度指数 INLET ISEN. TEMP. EXPONENT	1.50146	
吐出温度 ISEN. STATIC DISCH. TEMP.	337.94	K
吐出比容積 ISEN. STATIC DISCH. SP. VOL.	0.159915	m^3/kg
等エントロピー圧縮時吐出エンタルピ ISEN STATIC DISCH. ENTHALPY	126.213	kcal/kg
等エントロピー容積指数 OVERALL ISENTROPIC VOL. EXPONENT	1.51245	
等エントロピーワーク ISENTROPIC WORK	4713.26	m
等エントロピーヘッド ISENTROPIC HEAD	4710.77	m
ワークファクター WORK FACTOR	1.00053	
ポリトロープ指数 OVERALL POLYTROPIC VOL. EXPONENT	1.82786	
吐出エンタルピ DICH. ENTHALPY	130.225	kcal/kg
ガス入力 POWER INPUT TO GAS	15.0518	kcal/kg
ポリトロープヘッド PORYTROPIC HEAD	4788.51	m
ポリトロープワーク PORYTROPIC WORK	430.468	kW
ポリトロープ効率 PORYTROPIC EFFICIENCY	74.5169	%
吸込全風量 INLET STAG. CAPACITY	6320.9	$m^3/hr.$

仕様状態換算 CONVERSION TO SPECIFIED CONDITION

項目 ITEM	計算結果 CALC. RESULT	単位 UNIT
回転数比 SPEED RATIO	1.44995	
比容積比 CONVERTED VOLUME RATIO	1.15908	
換算風量 CONVERTED INLET STAG. CAPACITY	9164.99	$m^3/hr.$
換算重量流量 CONVERTED INLET FLOW RATE	152735	kg/hr.
換算ヘッド CONVERTED POLYTROPIC HEAD	10154.1	m
換算効率 CONVERTED POLYTROPIC EFFICIENCY	75.1608	%
換算吐出圧 CONVERTED DISCHARGE PRESS.	83.5657	kgf/cm^2A
換算吐出温度 CONVERTED DISCHARGE TEMP.	82.36	℃
換算ガス馬力 CONVERTED GAS POWER	5620.94	kW

INSPECTION TEAM
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御立会者 WITNESSED BY　　日付 DATE

審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA　　03/09/30

性能試験結果
PERFORMANCE TEST LOG. (1/4)

オリフィスデータ
ORIFICE DATA 26

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 55　　計測NO. RUN NO. : 57
オリフィスNO. : 1 ORIFICE NO.

計測日時 MES. DATE : 03 / 9 / 30 17 : 15
コメント COMMENT : surge

パラメータ PARAMETER	上流 圧力 UPSTREAM PRESS.	上流 温度 UPSTREAM TEMP.	差圧 DIFF. PRESS.	大気圧 ATM PRESS.
計測値－1 OBSERVED DATA -1	8.9520 kgf/cm^{2}G	33.50 ℃	0.0796 kgf/cm^2	1.0285 kgf/cm^{2}A
計測値－2 OBSERVED DATA -2	9.0286 kgf/cm^{2}G	33.94 ℃	0.0799 kgf/cm^2	
誤差 DIFFERENTIAL	0.0766 kgf/cm^{2}G	0.44 ℃	0.0003 kgf/cm^2	
平均値 AVERAGE	10.0188 kgf/cm^{2}A	306.87 K	0.0797 kgf/cm^2	1.0285 kgf/cm^{2}A
誤差率 FLUCTUATION	0.00 %	0.00 %	0.00 %	
最終平均値 FINAL AVE.VALUE	10.0188 kgf/cm^{2}A	306.87 K	0.0797 kgf/cm^2	

計算値 CALCULATED VALUE				
オリフィス通過流量 ORIFICE FLOW RATE	12426.8 kg/hr.	流量係数 FLOW COEFFICIENT	0.644346	
オリフィス上流比容積 UPSTREAM SP VOL.	0.16368 m^3/kg	上流ガス粘度 UPSTREAM GAS VISCOSITY	0.016074	centipoise
膨張係数 EXPANSION FACTOR	0.99761	熱膨張係数 THERMAL EXPANSION FACTOR	1.00043	
レイノルズ数 UPSTREAM RE NO.	1.07571E+06	温度指数 ISEN TEMP. EXP.	1.50154	
線膨張率 ALPHA	8.9186E-06			

INSPECTION TEAM
☑ WITNESSED ☐ REVIEWED
LG E&C

御立会者 WITNESSED BY　　日付 DATE

審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA　　03/09/30

性能試験結果
PERFORMANCE TEST LOG. (2/4)

セクションデータ SECTION DATA 27

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 55　　計測NO. RUN NO. : 57

セクションNO. SECTION NO. : 1

計測日時 MES. DATE : 03 / 9 / 30 17 : 15

コメント COMMENT : surge

パラメータ PARAMETER	吸込 圧力 INLET PRESS.	吸込 温度 INLET TEMP.	吐出 圧力 DISCH. PRESS.	吐出 温度 DISCH. TEMP.
計測値－1 OBSERVED DATA - 1	7.3658 kgf/cm^{2}G	33.45 ℃	11.1384 kgf/cm^{2}G	90.87 ℃
計測値－2 OBSERVED DATA - 2	7.3399 kgf/cm^{2}G	33.45 ℃	11.1349 kgf/cm^{2}G	90.52 ℃
計測値－3 OBSERVED DATA - 3	7.3505 kgf/cm^{2}G	33.46 ℃	11.1255 kgf/cm^{2}G	90.56 ℃
計測値－4 OBSERVED DATA - 4	7.3622 kgf/cm^{2}G	33.52 ℃	11.1279 kgf/cm^{2}G	90.80 ℃
誤差 DIFFERENTIAL	0.0259 kgf/cm^{2}G	0.08 ℃	0.0129 kgf/cm^{2}G	0.35 ℃
平均値 AVERAGE	8.3831 kgf/cm^{2}A	306.62 K	12.1602 kgf/cm^{2}A	363.84 K
誤差率 FLUCTUATION	0.00 %	0.00 %	0.00 %	0.00 %
最終平均値 FINAL AVE. VALUE	8.3831 kgf/cm^{2}A	306.62 K	12.1602 kgf/cm^{2}A	363.84 K

パラメータ PARAMETER	回転数 SPEED	大気圧 ATM PRESS.		
計測値－1 OBSERVED DATA - 1	6612 min^{-1}	1.0285 kgf/cm^{2}A		
計測値－2 OBSERVED DATA - 2				
計測値－3 OBSERVED DATA - 3				
計測値－4 OBSERVED DATA - 4				
誤差 DIFFERENTIAL				
平均値 AVERAGE	6612 min^{-1}	1.0285 kgf/cm^2		
誤差率 FLUCTUATION	0.00 %			
最終平均値 FINAL AVE. VALUE	6612 min^{-1}			

INSPECTION TEAM
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御立会者 WITNESSED BY　　日付 DATE

審査 TEST ENGINEER　　日付 DATE

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性能試験結果
PERFORMANCE TEST LOG. (3/4)

試験条件28
TEST CONDITIONS

顧客名 CUSTOMER	アイテムNo. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 55　　計測NO. RUN NO. : 57

セクションNO. SECTION NO. : 1

計測日時 MES. DATE : 03 / 9 / 30 17 : 15

コメント COMMENT : surge

計測値 OBSERVED DATA　試験ガス成分 TEST GAS PURITY

49.73 % [N2]
50.27 % [He]
0.00 % [O2]

計算値 CORRECTION DATA　重量流量 FLOW RATE　12426.8 kg/hr.

	パラメーター PARAMETER	計算結果 TEST RESULT	単位 UNIT
吸込 INLET	吸込静比容積 SP. VOL. (STATIC)	0.195306	m^3/kg
	吸込静風量 STATIC CAPACITY	2427.26	$m^3/hr.$
	吸込流速 GAS VELOCITY	7.43372	m/sec
	吸込動圧 VEL. PRESS.	0.0014	kgf/cm^2
	吸込静比熱 SP. HEAT (CP)	0.375004	kcal/kg°C
	吸込動温 VEL. TEMP.	0.02	K
	吸込全圧 STAG. PRESS.	8.3845	kgf/cm^2A
	吸込全温 STAG. TEMP.	306.63	K
	吸込全比容積 SP. VOL. (STAG.)	0.195277	m^3/kg
	吸込全風量 STAG. CAPACITY	2426.89	$m^3/hr.$

	パラメーター PARAMETER	計算結果 TEST RESULT	単位 UNIT
吐出 DISCH.	吐出静比容積 SP. VOL. (STATIC)	0.160054	m^3/kg
	吐出静風量 STATIC CAPACITY	1989.15	$m^3/hr.$
	吐出流速 GAS VELOCITY	7.57944	m/sec
	吐出動圧 VEL. PRESS.	0.0018	kgf/cm^2
	吐出静比熱 SP. HEAT (CP)	0.375412	kcal/kg°C
	吐出動温 VEL. TEMP.	0.02	K
	吐出全圧 STAG. PRESS.	12.1620	kgf/cm^2A
	吐出全温 STAG. TEMP.	363.85	K
	吐出全比容積 SP. VOL. (STAG.)	0.160033	m^3/kg
	吐出全風量 STAG. CAPACITY	1988.89	$m^3/hr.$

パラメーター PARAMETER	計算結果 TEST RESULT	単位 UNIT
流量回転数比 TEST CAPACITY - SPEED RATIO	0.367051	
% Q／N比（キャパシティースピードレシオ） % CAPACITY - SPEED RATIO	50.84	%
比容積比 TEST VOLUME RATIO	1.22023	
% 比容積比 % VOLUME RATIO	99.61	%
羽根周速 TEST PERIPHERAL SPEED	151.115	m/sec
粘度（センチポアズ） TEST INLET GAS VISCOSITY	0.0160503	centipoise
動粘度（ストークス） TEST INLET KINETIC VISCOSITY	0.031345	stokes
テストレイノルズ数 TEST REYNOLDS NUMBER	909245	
% RE比 % REYNOLDS NUMBER RATIO	14.18	%
音速 TEST INLET ACOUSTIC VELOCITY	492.543	m/sec
テストマッハ数比 TEST MACH NUMBER RATIO	0.306806	
% マッハ数 % MACH NUMBER	102.95	%
ポリトロープ効率 TEST POLYTROPIC EFFICIENCY	72.55	%
テストガス馬力 TEST POLYTROPIC GAS POWER	310.268	kW

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ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

性能試験結果
PERFORMANCE TEST LOG. (4/4)

仕様状態への換算 29
CONVERSION TO SPECIFIED CONDITIONS

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 55　　計測NO. RUN NO. : 57　　計測日時 MES. DATE : 03 / 9 / 30 17 : 15

セクションNO. SECTION NO. : 1　　コメント COMMENT : surge

性能試験結果 CALCULATION OF TEST RESULT

項目 ITEM	計算結果 CALC. RESULT	単位 UNIT
吸込エンタルピ INLET ENTHALPY	114.424	kcal/kg
吸込エントロピー INLET ENTROPY	1.84039	kcal/kg°C
等エントロピー温度指数 INLET ISEN. TEMP. EXPONENT	1.5014	
吐出温度 ISEN. STATIC DISCH. TEMP.	347.16	K
吐出比容積 ISEN. STATIC DISCH. SP. VOL.	0.1527	m^3/kg
等エントロピー圧縮時吐出エンタルピ ISEN STATIC DISCH. ENTHALPY	129.629	kcal/kg
等エントロピー容積指数 OVERALL ISENTROPIC VOL. EXPONENT	1.51226	
等エントロピーワーク ISENTROPIC WORK	6491.5	m
等エントロピーヘッド ISENTROPIC HEAD	6490.29	m
ワークファクター WORK FACTOR	1.00019	
ポリトロープ指数 OVERALL POLYTROPIC VOL. EXPONENT	1.86863	
吐出エンタルピ DICH. ENTHALPY	135.893	kcal/kg
ガス入力 POWER INPUT TO GAS	21.4686	kcal/kg
ポリトロープヘッド PORYTROPIC HEAD	6649.42	m
ポリトロープワーク PORYTROPIC WORK	225.092	kW
ポリトロープ効率 PORYTROPIC EFFICIENCY	72.5476	%
吸込全風量 INLET STAG. CAPACITY	2426.89	$m^3/hr.$

仕様状態換算 CONVERSION TO SPECIFIED CONDITION

項目 ITEM	計算結果 CALC. RESULT	単位 UNIT
回転数比 SPEED RATIO	1.45057	
比容積比 CONVERTED VOLUME RATIO	1.2232	
換算風量 CONVERTED INLET STAG. CAPACITY	3520.38	$m^3/hr.$
換算重量流量 CONVERTED INLET FLOW RATE	58667.4	kg/hr.
換算ヘッド CONVERTED POLYTROPIC HEAD	14127.2	m
換算効率 CONVERTED POLYTROPIC EFFICIENCY	73.2514	%
換算吐出圧 CONVERTED DISCHARGE PRESS.	91.4159	kgf/cm^2A
換算吐出温度 CONVERTED DISCHARGE TEMP.	93.83	℃
換算ガス馬力 CONVERTED GAS POWER	3082.15	kW

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審査 TEST ENGINEER　　日付 DATE

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性能試験結果

PERFORMANCE TEST LOG. (1/4)

オリフィスデータ
ORIFICE DATA 30

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 4　　計測NO. RUN NO. : 5　　計測日時 MES. DATE : 03 / 9 / 30 18 : 5

オリフィスNO. ORIFICE NO. : 1　　コメント COMMENT : point 4

パラメータ PARAMETER	上流 圧力 UPSTREAM PRESS.	上流 温度 UPSTREAM TEMP.	差圧 DIFF. PRESS.	大気圧 ATM PRESS.
計測値－1 OBSERVED DATA-1	9.0153 kgf/cm²G	34.21 ℃	0.0872 kgf/cm²	1.0297 kgf/cm²A
計測値－2 OBSERVED DATA-2	9.0924 kgf/cm²G	34.80 ℃	0.0883 kgf/cm²	
誤差 DIFFERENTIAL	0.0771 kgf/cm²G	0.59 ℃	0.0010 kgf/cm²	
平均値 AVERAGE	10.0835 kgf/cm²A 10.0573 10.0617	307.66 K 307.73 307.75	0.0878 kgf/cm² 0.0872 0.0876	1.0297 kgf/cm²A 1.0296 1.0295
誤差率 FLUCTUATION	0.26 %	0.03 %	0.58 %	
最終平均値 FINAL AVE.VALUE	10.0675 kgf/cm²A	307.71 K	0.0875 kgf/cm²	

計算値 CALCULATED VALUE				
オリフィス通過流量 ORIFICE FLOW RATE	13028 kg/hr.		流量係数 FLOW COEFFICIENT	0.64431
オリフィス上流比容積 UPSTREAM SP VOL.	0.163388 m³/kg		上流ガス粘度 UPSTREAM GAS VISCOSITY	0.0161015 centipoise
膨張係数 EXPANSION FACTOR	0.997389		熱膨張係数 THERMAL EXPANSION FACTOR	1.00046
レイノルズ数 UPSTREAM RE NO.	1.12582E+06		温度指数 ISEN TEMP. EXP.	1.50159
線膨張率 ALPHA	8.9186E-06			

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御立会者 WITNESSED BY　　日付 DATE

審査 TEST ENGINEER　　日付 DATE

N. ISHIKAWA　　03/09/30

性能試験結果
PERFORMANCE TEST LOG. (2/4)

セクションデータ
SECTION DATA 31

顧客名 CUSTOMER	アイテムNo. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 4　　計測NO. RUN NO. : 5
セクションNO. SECTION NO. : 1

計測日時 MES. DATE : 03 / 9 / 30 18 : 5
コメント COMMENT : point 4

パラメータ PARAMETER	吸込 圧力 INLET PRESS.	吸込 温度 INLET TEMP.	吐出 圧力 DISCH. PRESS.	吐出 温度 DISCH. TEMP.
計測値－1 OBSERVED DATA - 1	7.2107 kgf/cm²G	33.70 ℃	10.9102 kgf/cm²G	92.10 ℃
計測値－2 OBSERVED DATA - 2	7.1843 kgf/cm²G	33.80 ℃	10.9085 kgf/cm²G	91.77 ℃
計測値－3 OBSERVED DATA - 3	7.1947 kgf/cm²G	33.70 ℃	10.8978 kgf/cm²G	91.71 ℃
計測値－4 OBSERVED DATA - 4	7.2070 kgf/cm²G	33.70 ℃	10.8990 kgf/cm²G	91.99 ℃
誤差 DIFFERENTIAL	0.0264 kgf/cm²G	0.10 ℃	0.0124 kgf/cm²G	0.39 ℃
平均値 AVERAGE	8.2288 kgf/cm²A 8.2072 8.2125	306.88 K 306.92 306.99	11.9335 kgf/cm²A 11.9041 11.9115	365.04 K 365.18 365.32
誤差率 FLUCTUATION	0.26 %	0.04 %	0.25 %	0.08 %
最終平均値 FINAL AVE. VALUE	8.2162 kgf/cm²A	306.93 K	11.9164 kgf/cm²A	365.18 K

パラメータ PARAMETER	回転数 SPEED	大気圧 ATM PRESS.		
計測値－1 OBSERVED DATA - 1	6614 min⁻¹	1.0297 kgf/cm²A		
計測値－2 OBSERVED DATA - 2				
計測値－3 OBSERVED DATA - 3				
計測値－4 OBSERVED DATA - 4				
誤差 DIFFERENTIAL				
平均値 AVERAGE	6614 min⁻¹ 6615 6615	1.0297 kgf/cm² 1.0296 1.0295		
誤差率 FLUCTUATION	0.01 %			
最終平均値 FINAL AVE. VALUE	6615 min⁻¹			

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審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA　　03/09/30

性能試験結果
PERFORMANCE TEST LOG. (3/4)

試験条件 32
TEST CONDITIONS

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 4　　計測NO. RUN NO. : 5

セクションNO. SECTION NO. : 1

計測日時 MES. DATE : 03 / 9 / 30 18 : 5

コメント COMMENT : point 4

計測値 OBSERVED DATA　試験ガス成分 TEST GAS PURITY

49.71 % [N2]
50.29 % [He]
0.00 % [O2]

計算値 CORRECTION DATA　重量流量 FLOW RATE

13028 kg/hr.

	パラメーター PARAMETER	計算結果 TEST RESULT	単位 UNIT
吸込 INLET	吸込静比容積 SP. VOL. (STATIC)	0.199518	m^3/kg
	吸込静風量 STATIC CAPACITY	2599.58	$m^3/hr.$
	吸込流速 GAS VELOCITY	7.96147	m/sec
	吸込動圧 VEL. PRESS.	0.0016	kgf/cm^2
	吸込静比熱 SP. HEAT (CP)	0.375062	kcal/kg°C
	吸込動温 VEL. TEMP.	0.02	K
	吸込全圧 STAG. PRESS.	8.2178	kgf/cm^2A
	吸込全温 STAG. TEMP.	306.94	K
	吸込全比容積 SP. VOL. (STAG.)	0.199484	m^3/kg
	吸込全風量 STAG. CAPACITY	2599.13	$m^3/hr.$

	パラメーター PARAMETER	計算結果 TEST RESULT	単位 UNIT
吐出 DISCH.	吐出静比容積 SP. VOL. (STATIC)	0.16396	m^3/kg
	吐出静風量 STATIC CAPACITY	2136.29	$m^3/hr.$
	吐出流速 GAS VELOCITY	8.14009	m/sec
	吐出動圧 VEL. PRESS.	0.0021	kgf/cm^2
	吐出静比熱 SP. HEAT (CP)	0.375478	kcal/kg°C
	吐出動温 VEL. TEMP.	0.02	K
	吐出全圧 STAG. PRESS.	11.9184	kgf/cm^2A
	吐出全温 STAG. TEMP.	365.19	K
	吐出全比容積 SP. VOL. (STAG.)	0.163936	m^3/kg
	吐出全風量 STAG. CAPACITY	2135.96	$m^3/hr.$

パラメーター PARAMETER	計算結果 TEST RESULT	単位 UNIT
流量回転数比 TEST CAPACITY-SPEED RATIO	0.392927	
% Q／N比（キャパシティースピードレシオ） % CAPACITY-SPEED RATIO	54.43	%
比容積比 TEST VOLUME RATIO	1.21684	
% 比容積比 % VOLUME RATIO	99.33	%
羽根周速 TEST PERIPHERAL SPEED	151.182	m/sec
粘度（センチポアズ） TEST INLET GAS VISCOSITY	0.0160578	centipoise
動粘度（ストークス） TEST INLET KINETIC VISCOSITY	0.0320353	stokes
テストレイノルズ数 TEST REYNOLDS NUMBER	890045	
% RE比 % REYNOLDS NUMBER RATIO	13.89	%
音速 TEST INLET ACOUSTIC VELOCITY	492.818	m/sec
テストマッハ数比 TEST MACH NUMBER RATIO	0.30677	
% マッハ数 % MACH NUMBER	102.94	%
ポリトロープ効率 TEST POLYTROPIC EFFICIENCY	71.41	%
テストガス馬力 TEST POLYTROPIC GAS POWER	331.213	kW

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性能試験結果
PERFORMANCE TEST LOG. (4/4)

仕様状態への換算 33
CONVERSION TO SPECIFIED CONDITIONS

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 4　　計測NO. RUN NO. : 5

セクションNO. SECTION NO. : 1

計測日時 MES. DATE : 03 / 9 / 30 18 : 5

コメント COMMENT : point 4

性能試験結果 CALCULATION OF TEST RESULT

項目 ITEM	計算結果 CALC. RESULT	単位 UNIT
吸込エンタルピ INLET ENTHALPY	114.568	kcal/kg
吸込エントロピー INLET ENTROPY	1.84369	kcal/kg℃
等エントロピー温度指数 INLET ISEN. TEMP. EXPONENT	1.50143	
吐出温度 ISEN. STATIC DISCH. TEMP.	347.50	K
吐出比容積 ISEN. STATIC DISCH. SP. VOL.	0.156	m^3/kg
等エントロピー圧縮時吐出エンタルピ ISEN STATIC DISCH. ENTHALPY	129.785	kcal/kg
等エントロピー容積指数 OVERALL ISENTROPIC VOL. EXPONENT	1.51206	
等エントロピーワーク ISENTROPIC WORK	6496.78	m
等エントロピーヘッド ISENTROPIC HEAD	6495.54	m
ワークファクター WORK FACTOR	1.00019	
ポリトロープ指数 OVERALL POLYTROPIC VOL. EXPONENT	1.89435	
吐出エンタルピ DICH. ENTHALPY	136.428	kcal/kg
ガス入力 POWER INPUT TO GAS	21.8602	kcal/kg
ポリトロープヘッド PORYTROPIC HEAD	6664.13	m
ポリトロープワーク PORYTROPIC WORK	236.504	kW
ポリトロープ効率 PORYTROPIC EFFICIENCY	71.4056	%
吸込全風量 INLET STAG. CAPACITY	2599.13	m^3/hr.

仕様状態換算 CONVERSION TO SPECIFIED CONDITION

項目 ITEM	計算結果 CALC. RESULT	単位 UNIT
回転数比 SPEED RATIO	1.44993	
比容積比 CONVERTED VOLUME RATIO	1.22143	
換算風量 CONVERTED INLET STAG. CAPACITY	3768.56	m^3/hr.
換算重量流量 CONVERTED INLET FLOW RATE	62803.3	kg/hr.
換算ヘッド CONVERTED POLYTROPIC HEAD	14156.6	m
換算効率 CONVERTED POLYTROPIC EFFICIENCY	72.153	%
換算吐出圧 CONVERTED DISCHARGE PRESS.	91.4507	kgf/cm^2A
換算吐出温度 CONVERTED DISCHARGE TEMP.	94.49	℃
換算ガス馬力 CONVERTED GAS POWER	3356.65	kW

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性能試験結果
PERFORMANCE TEST LOG. (1/4)

オリフィスデータ
ORIFICE DATA 34

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 5　　計測NO. RUN NO. : 5
オリフィスNO. : 1 ORIFICE NO.

計測日時 MES. DATE : 03 / 9 / 30 18 : 57
コメント COMMENT : point 5

パラメータ PARAMETER	上流 圧力 UPSTREAM PRESS.	上流 温度 UPSTREAM TEMP.	差圧 DIFF. PRESS.	大気圧 ATM PRESS.
計測値－1 OBSERVED DATA -1	9.1368 kgf/cm²G	37.90 ℃	0.1656 kgf/cm²	1.0308 kgf/cm²A
計測値－2 OBSERVED DATA -2	9.2144 kgf/cm²G	38.63 ℃	0.1657 kgf/cm²	
誤差 DIFFERENTIAL	0.0776 kgf/cm²G	0.73 ℃	0.0001 kgf/cm²	
平均値 AVERAGE	10.2064 kgf/cm²A	311.41 K	0.1657 kgf/cm²	1.0308 kgf/cm²A
	10.2067	311.46	0.1656	1.0306
	10.1888	311.49	0.1649	1.0306
誤差率 FLUCTUATION	0.18 %	0.03 %	0.44 %	
最終平均値 FINAL AVE.VALUE	10.2006 kgf/cm²A	311.45 K	0.1654 kgf/cm²	

計算値 CALCULATED VALUE				
オリフィス通過流量 ORIFICE FLOW RATE	17875.9 kg/hr.	流量係数 FLOW COEFFICIENT	0.644085	
オリフィス上流比容積 UPSTREAM SP VOL.	0.16318 m³/kg	上流ガス粘度 UPSTREAM GAS VISCOSITY	0.0162295	centipoise
膨張係数 EXPANSION FACTOR	0.99513	熱膨張係数 THERMAL EXPANSION FACTOR	1.00058	
レイノルズ数 UPSTREAM RE NO.	1.53258E+06	温度指数 ISEN TEMP. EXP.	1.50149	
線膨張率 ALPHA	8.9186E-06			

INSPECTION TEAM
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審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA　　03/09/30

性能試験結果

PERFORMANCE TEST LOG. (2/4)

セクションデータ
SECTION DATA 35

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA.SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 5　　計測NO. RUN NO. : 5

セクションNO. SECTION NO. : 1

計測日時 MES. DATE : 03 / 9 / 30 18 : 57

コメント COMMENT : point 5

パラメータ PARAMETER	吸込 圧力 INLET PRESS.	吸込 温度 INLET TEMP.	吐出 圧力 DISCH. PRESS.	吐出 温度 DISCH. TEMP.
計測値－1 OBSERVED DATA - 1	7.1932 kgf/cm²G	37.10 ℃	10.8236 kgf/cm²G	90.00 ℃
計測値－2 OBSERVED DATA - 2	7.1678 kgf/cm²G	37.30 ℃	10.8226 kgf/cm²G	89.60 ℃
計測値－3 OBSERVED DATA - 3	7.1771 kgf/cm²G	37.10 ℃	10.8117 kgf/cm²G	89.55 ℃
計測値－4 OBSERVED DATA - 4	7.1890 kgf/cm²G	37.11 ℃	10.8132 kgf/cm²G	89.79 ℃
誤差 DIFFERENTIAL	0.0254 kgf/cm²G	0.20 ℃	0.0120 kgf/cm²G	0.45 ℃
平均値 AVERAGE	8.2126 kgf/cm²A 8.2119 8.1971	310.30 K 310.30 310.37	11.8486 kgf/cm²A 11.8484 11.8281	362.88 K 362.93 362.91
誤差率 FLUCTUATION	0.19 %	0.02 %	0.17 %	0.01 %
最終平均値 FINAL AVE. VALUE	8.2072 kgf/cm²A	310.32 K	11.8417 kgf/cm²A	362.91 K

パラメータ PARAMETER	回転数 SPEED	大気圧 ATM PRESS.		
計測値－1 OBSERVED DATA - 1	6614 min⁻¹	1.0308 kgf/cm²A		
計測値－2 OBSERVED DATA - 2				
計測値－3 OBSERVED DATA - 3				
計測値－4 OBSERVED DATA - 4				
誤差 DIFFERENTIAL				
平均値 AVERAGE	6614 min⁻¹ 6614 6615	1.0308 kgf/cm² 1.0306 1.0306		
誤差率 FLUCTUATION	0.00 %			
最終平均値 FINAL AVE. VALUE	6615 min⁻¹			

INSPECTION TEAM
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審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA　　03/09/30

性能試験結果
PERFORMANCE TEST LOG. (3/4)

試験条件 36
TEST CONDITIONS

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 5　　計測NO. RUN NO. : 5

セクションNO. SECTION NO. : 1

計測日時 MES. DATE : 03 / 9 / 30 18 : 57

コメント COMMENT : point 5

計測値 OBSERVED DATA　試験ガス成分 TEST GAS PURITY

49.73 % [N2]
50.27 % [He]
0.00 % [O2]

計算値 CORRECTION DATA　重量流量 FLOW RATE

17875.9 kg/hr.

	パラメーター PARAMETER	計算結果 TEST RESULT	単位 UNIT
吸込 INLET	吸込静比容積 SP. VOL. (STATIC)	0.201885	m^3/kg
	吸込静風量 STATIC CAPACITY	3609.23	$m^3/hr.$
	吸込流速 GAS VELOCITY	11.0536	m/sec
	吸込動圧 VEL. PRESS.	0.0031	kgf/cm^2
	吸込静比熱 SP. HEAT (CP)	0.374953	kcal/kg°C
	吸込動温 VEL. TEMP.	0.04	K
	吸込全圧 STAG. PRESS.	8.2103	kgf/cm^2A
	吸込全温 STAG. TEMP.	310.34	K
	吸込全比容積 SP. VOL. (STAG.)	0.201818	m^3/kg
	吸込全風量 STAG. CAPACITY	3608.03	$m^3/hr.$

	パラメーター PARAMETER	計算結果 TEST RESULT	単位 UNIT
吐出 DISCH.	吐出静比容積 SP. VOL. (STATIC)	0.163912	m^3/kg
	吐出静風量 STATIC CAPACITY	2930.35	$m^3/hr.$
	吐出流速 GAS VELOCITY	11.1658	m/sec
	吐出動圧 VEL. PRESS.	0.0039	kgf/cm^2
	吐出静比熱 SP. HEAT (CP)	0.375375	kcal/kg°C
	吐出動温 VEL. TEMP.	0.04	K
	吐出全圧 STAG. PRESS.	11.8456	kgf/cm^2A
	吐出全温 STAG. TEMP.	362.92	K
	吐出全比容積 SP. VOL. (STAG.)	0.163864	m^3/kg
	吐出全風量 STAG. CAPACITY	2929.51	$m^3/hr.$

パラメーター PARAMETER	計算結果 TEST RESULT	単位 UNIT
流量回転数比 TEST CAPACITY - SPEED RATIO	0.545467	
% Q／N比（キャパシティースピードレシオ） % CAPACITY - SPEED RATIO	75.56	%
比容積比 TEST VOLUME RATIO	1.23162	
% 比容積比 % VOLUME RATIO	100.54	%
羽根周速 TEST PERIPHERAL SPEED	151.177	m/sec
粘度（センチポアズ） TEST INLET GAS VISCOSITY	0.0161735	centipoise
動粘度（ストークス） TEST INLET KINETIC VISCOSITY	0.0326435	stokes
テストレイノルズ数 TEST REYNOLDS NUMBER	873433	
% RE比 % REYNOLDS NUMBER RATIO	13.63	%
音速 TEST INLET ACOUSTIC VELOCITY	495.436	m/sec
テストマッハ数比 TEST MACH NUMBER RATIO	0.305139	
% マッハ数 % MACH NUMBER	102.40	%
ポリトロープ効率 TEST POLYTROPIC EFFICIENCY	78.16	%
テストガス馬力 TEST POLYTROPIC GAS POWER	410.13	kW

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審査 TEST ENGINEER　日付 DATE

N.ISHIKAWA　03/09/30

性能試験結果
PERFORMANCE TEST LOG. (4/4)

仕様状態への換算 37
CONVERSION TO SPECIFIED CONDITIONS

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

ログNO. LOG NO. : 5　　計測NO. RUN NO. : 5

セクションNO. SECTION NO. : 1

計測日時 MES. DATE : 03 / 9 / 30 18 : 57

コメント COMMENT : point 5

性能試験結果 CALCULATION OF TEST RESULT

項目 ITEM	計算結果 CALC. RESULT	単位 UNIT
吸込エンタルピ INLET ENTHALPY	115.816	kcal/kg
吸込エントロピー INLET ENTROPY	1.84753	kcal/kg℃
等エントロピー温度指数 INLET ISEN. TEMP. EXPONENT	1.50133	
吐出温度 ISEN. STATIC DISCH. TEMP.	350.73	K
吐出比容積 ISEN. STATIC DISCH. SP. VOL.	0.158365	m^3/kg
等エントロピー圧縮時吐出エンタルピ ISEN STATIC DISCH. ENTHALPY	130.968	kcal/kg
等エントロピー容積指数 OVERALL ISENTROPIC VOL. EXPONENT	1.51183	
等エントロピーワーク ISENTROPIC WORK	6468.86	m
等エントロピーヘッド ISENTROPIC HEAD	6467.47	m
ワークファクター WORK FACTOR	1.00021	
ポリトロープ指数 OVERALL POLYTROPIC VOL. EXPONENT	1.75957	
吐出エンタルピ DICH. ENTHALPY	135.544	kcal/kg
ガス入力 POWER INPUT TO GAS	19.7278	kcal/kg
ポリトロープヘッド PORYTROPIC HEAD	6582.87	m
ポリトロープワーク PORYTROPIC WORK	320.554	kW
ポリトロープ効率 PORYTROPIC EFFICIENCY	78.1593	%
吸込全風量 INLET STAG. CAPACITY	3608.03	m^3/hr.

仕様状態換算 CONVERSION TO SPECIFIED CONDITION

項目 ITEM	計算結果 CALC. RESULT	単位 UNIT
回転数比 SPEED RATIO	1.44998	
比容積比 CONVERTED VOLUME RATIO	1.23037	
換算風量 CONVERTED INLET STAG. CAPACITY	5231.57	m^3/hr.
換算重量流量 CONVERTED INLET FLOW RATE	87184.5	kg/hr.
換算ヘッド CONVERTED POLYTROPIC HEAD	13942.9	m
換算効率 CONVERTED POLYTROPIC EFFICIENCY	78.7398	%
換算吐出圧 CONVERTED DISCHARGE PRESS.	91.1539	kgf/cm^2A
換算吐出温度 CONVERTED DISCHARGE TEMP.	90.74	℃
換算ガス馬力 CONVERTED GAS POWER	4205.47	kW

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N.ISHIKAWA　　03/09/30

7 Calibration Record

計器検定成績書
INSTRUMENT TEST CERTIFICATE

管理番号
Manage No. System-B (PT-1,PT-2)

型式
Type Pressure Measuring System

測定範囲
Range

Pressure Transducer	0-3500kPaG (~~Apply~~ / Not Apply)
	0-2000kPaG (Apply / ~~Not Apply~~)
	0-1000kPaG (Apply / ~~Not Apply~~)
	-100-300kPaG (~~Apply~~ / Not Apply)
	-100-100kPaG (~~Apply~~ / Not Apply)
Diff. Pressure Transducer	0-100kpa (Apply / ~~Not Apply~~)

最大許容差
Tolerance of Accuracy

Pressure Transducer	±0.25% of F.S.

基準器
Standard Instrument

型式 Type	Druck DPI-510 Pressure Calibrater	管理番号 Manage No.	1599/94-3

有効期限
Validity Date 2005/4/9

検定状態
Calibration Conditions

恒温槽温度
Insuration Box Temperature. 50℃

検定結果
Calibration Result

圧力トランスデューサーの検定結果は別掲します。
Detail calibration record of each pressure transducers are attached following.

LG E&C INSPECTION TEAM ☐ WITNESSED ☑ REVIEWED

試験者 Tested By S.SUZUKI

試験日 Date Sep. 18, '03

キャリブレーション記録（圧力）

CALIBRATION RECORD (1/4)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

Point no.: 527　　Tag no.: S1-IN-P1　　Tag name: S1-INLET-P1

Ch.no. : 17　　Range : 0.000 ~1000.000 (kPaG)

No. : 10　　Date : 03/09/18 14:18:29

（十側） A値 A-value : -0.000276887　　B値 B-value : 0.24702　　C値 C-value : -0.246611

No.	基準値 Standard Value (上昇) Up	(下降) Down	出力値 Output Value (上昇) Up	(下降) Down	精度 Accuracy % (上昇) Up	(下降) Down
1	0.000	0.000	-0.200	-0.900	-0.019	-0.093
2	200.000	200.000	200.000	199.900	0.001	-0.006
3	400.000	400.000	400.400	400.600	0.040	0.058
4	600.100	600.000	600.000	600.400	-0.007	0.040
5	800.000	800.000	800.500	800.700	0.052	0.065
6	1000.000		1000.700		0.072	

INSPECTION TEAM
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LG E&C

御立会者 WITNESSED BY　　日付 DATE

審査 TEST ENGINEER　　日付 DATE

S.SUZUKI　　03/09/19

キャリブレーション記録（圧力）

CALIBRATION RECORD (2/4)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

Point no.: 528　　Tag no.: S1-IN-P2　　Tag name: S1-INLET-P2

Ch.no. : 18　　Range : 0.000 ~1000.000 (kPaG)

No. : 10　　Date : 03/09/18 14:18:29

（十側） A値 A-value : -0.000248885　　B値 B-value : 0.247488　　C値 C-value : -0.246904

No.	基準値 Standard Value (上昇) Up	(下降) Down	出力値 Output Value (上昇) Up	(下降) Down	精度 Accuracy % (上昇) Up	(下降) Down
1	0.000	0.000	-0.500	-1.700	-0.046	-0.166
2	200.000	200.000	199.600	199.100	-0.037	-0.089
3	400.000	400.000	400.000	399.700	-0.002	-0.028
4	600.100	600.000	599.500	599.500	-0.055	-0.049
5	800.000	800.000	800.000	799.900	0.004	-0.005
6	1000.000		1000.100		0.012	

INSPECTION TEAM
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審査 TEST ENGINEER　　日付 DATE

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キャリブレーション記録（圧力）

CALIBRATION RECORD (3/4)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

Point no.: 529　　Tag no.: S1-IN-P3　　Tag name: S1-INLET-P3

Ch.no. : 19　　Range : 0.000 ~1000.000 (kPaG)

No. : 10　　Date : 03/09/18 14:18:29

（十側）　A値 A-value : -0.000309527　　B値 B-value : 0.248113　　C値 C-value : -0.246607

No.	基準値 Standard Value (上昇) Up	(下降) Down	出力値 Output Value (上昇) Up	(下降) Down	精度 Accuracy % (上昇) Up	(下降) Down
1	0.000	0.000	-0.400	-1.400	-0.039	-0.142
2	200.000	200.000	199.700	199.400	-0.025	-0.060
3	400.000	400.000	400.100	400.000	0.014	-0.003
4	600.100	600.000	599.700	599.800	-0.043	-0.023
5	800.000	800.000	800.300	800.300	0.028	0.030
6	1000.000		1000.500		0.050	

INSPECTION TEAM
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審査 TEST ENGINEER　　日付 DATE

S.SUZUKI　　03/09/19

キャリブレーション記録（圧力）

CALIBRATION RECORD (4/4)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

Point no.: 530　　Tag no.: S1-IN-P4　　Tag name: S1-INLET-P4

Ch.no. : 20　　Range : 0.000 ~1000.000 (kPaG)

No. : 10　　Date : 03/09/18 14:18:29

（十側） A値 A-value : −0.0002683　　B値 B-value : 0.246529　　C値 C-value : −0.244929

No.	基準値 Standard Value (上昇) Up	(下降) Down	出力値 Output Value (上昇) Up	(下降) Down	精度 Accuracy % (上昇) Up	(下降) Down
1	0.000	0.000	−0.100	−0.800	−0.014	−0.079
2	200.000	200.000	200.000	199.900	0.002	−0.006
3	400.000	400.000	400.400	400.500	0.039	0.047
4	600.100	600.000	600.000	600.200	−0.010	0.023
5	800.000	800.000	800.500	800.600	0.046	0.064
6	1000.000		1000.600		0.064	

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キャリブレーション記録（圧力）

CALIBRATION RECORD (1/2)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

Point no.: 503　　Tag no.: O1-UP-P1　　Tag name: 01-UPSTREAM-P1

Ch.no. : 15　　Range : 0.000 -1000.000 (kPaG)

No. : 10　　Date : 03/09/18 14:18:29

（十側） A値 A-value : -0.000126509　　B値 B-value : 0.250115　　C値 C-value : -0.219893

No.	基準値 Standard Value (上昇) Up	(下降) Down	出力値 Output Value (上昇) Up	(下降) Down	精度 Accuracy % (上昇) Up	(下降) Down
1	0.000	0.000	-0.700	-2.500	-0.071	-0.252
2	200.000	200.000	199.500	198.300	-0.052	-0.166
3	400.000	400.000	399.700	399.000	-0.034	-0.101
4	600.100	600.000	599.200	599.000	-0.090	-0.102
5	800.000	800.000	799.500	799.400	-0.046	-0.060
6	1000.000		999.700		-0.034	

INSPECTION TEAM
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審査 TEST ENGINEER　　日付 DATE

S.SUZUKI　　03/09/19

キャリブレーション記録（圧力）

CALIBRATION RECORD (2/2)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

Point no.: 504　　Tag no.: O1-UP-P2　　Tag name: 01-UPSTREAM-P2

Ch.no. : 16　　Range : 0.000 -1000.000 (kPaG)

No. : 10　　Date : 03/09/18 14:18:29

（十側）　A値 A-value : -0.000269767　　B値 B-value : 0.247267　　C値 C-value : -0.243366

No.	基準値 Standard Value (上昇) Up	(下降) Down	出力値 Output Value (上昇) Up	(下降) Down	精度 Accuracy % (上昇) Up	(下降) Down
1	0.000	0.000	-0.600	-1.900	-0.063	-0.187
2	200.000	200.000	199.600	198.900	-0.040	-0.113
3	400.000	400.000	400.000	399.700	-0.002	-0.033
4	600.100	600.000	599.500	599.500	-0.058	-0.050
5	800.000	800.000	800.100	800.000	0.007	0.003
6	1000.000		1000.200		0.025	

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キャリブレーション記録（圧力）

CALIBRATION RECORD (1/2)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

Point no.: 505　　Tag no.: O1-DP-P1　　Tag name: 01-DIFF-P1

Ch.no. : 41　　Range : 0.000 ~ 100.000 (kPaD)

No. : 10　　Date : 03/09/18 15:56:05

(十側)　A値 A-value : 0.0112343　　B値 B-value : 25.224　　C値 C-value : -24.6902

No.	基準値 Standard Value (上昇) Up	(下降) Down	出力値 Output Value (上昇) Up	(下降) Down	精度 Accuracy % (上昇) Up	(下降) Down
1	0.000	0.010	-0.010	-0.010	-0.005	-0.017
2	20.000	20.010	20.010	20.010	0.009	-0.001
3	40.020	40.000	40.030	40.020	0.015	0.024
4	60.010	60.010	59.980	59.990	-0.034	-0.025
5	80.000	80.000	79.980	79.980	-0.022	-0.018
6	100.000		100.010		0.015	

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御立会者 WITNESSED BY　　日付 DATE

審査 TEST ENGINEER　　日付 DATE

S. SUZUKI　　03/09/19

キャリブレーション記録（圧力）

CALIBRATION RECORD (2/2)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

Point no.: 506　　Tag no.: O1-DP-P2　　Tag name: 01-DIFF-P2

Ch.no. : 42　　Range : 0.000 ~ 100.000 (kPaD)

No. : 10　　Date : 03/09/18 15:56:05

（十側） A値 A-value : 0.00857251　　B値 B-value : 25.0239　　C値 C-value : -24.7146

No.	基準値 Standard Value (上昇) Up	(下降) Down	出力値 Output Value (上昇) Up	(下降) Down	精度 Accuracy % (上昇) Up	(下降) Down
1	0.000	0.010	-0.010	0.000	-0.008	-0.005
2	20.000	20.010	20.010	20.020	0.009	0.010
3	40.020	40.000	40.040	40.010	0.018	0.010
4	60.010	60.010	59.990	59.990	-0.018	-0.017
5	80.000	80.000	79.980	79.980	-0.018	-0.017
6	100.000		100.000		0.004	

INSPECTION TEAM
☐ WITNESSED ☑ REVIEWED
LG E&C

御立会者 WITNESSED BY　　日付 DATE

審査 TEST ENGINEER　　日付 DATE

S. SUZUKI　　03/09/19

キャリブレーション記録（圧力）

CALIBRATION RECORD (1/4)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

Point no.: 535　　Tag no.: S1-DI-P1　　Tag name: S1-DISCH-P1

Ch.no. : 63　　Range : 0.000 -2000.000 (kPaG)

No. : 10　　Date : 03/09/18 16:16:44

(十側)　A値 A-value : -0.000310526　　B値 B-value : 0.49213　　C値 C-value : -0.48621

No.	基準値 Standard Value (上昇) Up	(下降) Down	出力値 Output Value (上昇) Up	(下降) Down	精度 Accuracy % (上昇) Up	(下降) Down
1	0.000	0.000	-0.200	-0.300	-0.011	-0.016
2	400.000	400.000	399.900	399.800	-0.006	-0.012
3	799.900	800.000	799.700	799.900	-0.012	-0.007
4	1199.800	1200.000	1199.600	1199.800	-0.009	-0.012
5	1599.800	1600.000	1600.100	1600.200	0.014	0.010
6	2000.000		2000.300		0.016	

LG E&C　INSPECTION TEAM ☐ WITNESSED ☑ REVIEWED

御立会者 WITNESSED BY　　日付 DATE

審査 TEST ENGINEER　　日付 DATE

S. SUZUKI　　03/09/19

キャリブレーション記録（圧力）

CALIBRATION RECORD (2/4)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

Point no.: 536　　Tag no.: S1-DI-P2　　Tag name: S1-DISCH-P2

Ch.no. : 64　　Range : 0.000 -2000.000 (kPaG)

No. : 10　　Date : 03/09/18 16:16:44

（十側） A値 A-value : -0.000336958　　B値 B-value : 0.49388　　C値 C-value : -0.483248

No.	基準値 Standard Value (上昇) Up	(下降) Down	出力値 Output Value (上昇) Up	(下降) Down	精度 Accuracy % (上昇) Up	(下降) Down
1	0.000	0.000	-0.300	-0.400	-0.014	-0.019
2	400.000	400.000	399.800	399.800	-0.008	-0.010
3	799.900	800.000	799.900	799.900	-0.002	-0.003
4	1199.800	1200.000	1199.800	1199.800	-0.002	-0.009
5	1599.800	1600.000	1600.200	1600.200	0.019	0.011
6	2000.000		2000.300		0.013	

LG E&C　INSPECTION TEAM ☐ WITNESSED ☑ REVIEWED

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審査 TEST ENGINEER　　日付 DATE

S.SUZUKI　　03/09/19

キャリブレーション記録（圧力）

CALIBRATION RECORD (3/4)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

Point no.: 537　　Tag no.: S1-DI-P3　　Tag name: S1-DISCH-P3

Ch.no. : 65　　Range : 0.000 -2000.000 (kPaG)

No. : 10　　Date : 03/09/18 16:16:44

(十側)　A値 A-value : -0.00026941　　B値 B-value : 0.495053　　C値 C-value : -0.479654

No.	基準値 Standard Value (上昇) Up	(下降) Down	出力値 Output Value (上昇) Up	(下降) Down	精度 Accuracy % (上昇) Up	(下降) Down
1	0.000	0.000	-0.300	-0.600	-0.017	-0.031
2	400.000	400.000	399.800	399.600	-0.010	-0.019
3	799.900	800.000	799.600	799.600	-0.013	-0.022
4	1199.800	1200.000	1199.600	1199.700	-0.011	-0.013
5	1599.800	1600.000	1600.100	1600.100	0.016	0.004
6	2000.000		2000.000		0.001	

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審査 TEST ENGINEER　　日付 DATE

S.SUZUKI　　03/09/19

キャリブレーション記録（圧力）

CALIBRATION RECORD (4/4)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

Point no.: 538　　Tag no.: S1-DI-P4　　Tag name: S1-DISCH-P4

Ch.no. : 66　　Range : 0.000 2000.000 (kPaG)

No. : 10　　Date : 03/09/18 16:16:44

（十側）　A値 A-value : −0.00029848　　B値 B-value : 0.494078　　C値 C-value : −0.488082

No.	基準値 Standard Value (上昇) Up	(下降) Down	出力値 Output Value (上昇) Up	(下降) Down	精度 Accuracy % (上昇) Up	(下降) Down
1	0.000	0.000	−0.200	−0.600	−0.009	−0.029
2	400.000	400.000	399.900	399.600	−0.006	−0.020
3	799.900	800.000	799.800	799.900	−0.005	−0.005
4	1199.800	1200.000	1199.700	1199.800	−0.007	−0.010
5	1599.800	1600.000	1600.100	1600.200	0.015	0.011
6	2000.000		2000.200		0.008	

INSPECTION TEAM
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LG E&C

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審査 TEST ENGINEER　　日付 DATE

S.SUZUKI　　03/09/19

計器検定成績書
INSTRUMENT TEST CERTIFICATE

管理番号
Manage No. System-B

型式
Type Temperature Measuring System

測定範囲
Range
jPt100Ω
(-200) – 500 degC

最大許容差
Tolerance of Accuracy
±0.55degC

基準器
Standard Instrument

型式
Type Standard Temperature Gage

計器精度
Accuracy ±0.03degC

管理番号
Manage No.

0-50degC	3491
50-100degC	2626
100-150degC	5806

有効期限
Validity Date

3491	2007/9/12
2626	2008/1/13
5806	2006/12/21

検定状態
Calibration Conditions

気温
Ambient Temeprature 27.8 ℃

検定結果
Calibration Result

温度計の検定結果は別掲します。
Detail calibration record of each temperature detectors are attached following.

INSPECTION TEAM
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LG E&C

試験者 S.SUZUKI 試験日 Date Sep. 19, '03

Serial No.	R0215708
Model	25MB5
System	~~System-A~~/System-B

Junction Box. No.	Ch. No.	Tag No.	Sensor No.	Cable No.	Remarks
Bpt-A3	21	587	019	10-06	
↓	22	588	045	10-12	
↓	23	589	006	10-19	
↓	24	590	032	10-22	
↓	25	–			
↓	26	575	037	20-11	
↓	27	576	029	20-13	
↓	28	–			
↓	29	–			
↓	30	–			
Bpt-A4	31	595	008	10-25	
↓	32	596	021	10-29	
↓	33	597	033	10-41	
↓	34	598	041	10-43	
↓	35	–			
↓	36	–			
↓	37	–			
↓	38	–			
↓	39	–			
↓	40	–			

LG E&C
INSPECTION TEAM
☐ WITNESSED ☑ REVIEWED

試験者
Tested By S.SUZUKI

試験日
Date Sep. 19, '03

キャリブレーション記録（ＨＢ測温抵抗体） 54

CALIBRATION RECORD (RTD) (1/2)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

Point no.: 587 Tag no.: S1-IN-T1 Tag name: S1-INLET-T1 Ch.no.: 21 Unit: ℃

No.	日付 Date 時刻 Time	基準値 Standard Value	1	2	3	4	5	平均 Ave.	精度 Accuracy ℃
1	03/02/27 15:55	15.50	15.50	15.50	15.50	15.50	15.50	15.50	0.00
2	03/02/27 17:52	80.50	80.40	80.40	80.40	80.40	80.40	80.40	-0.10
3	03/05/21 10:13	18.30	18.50	18.50	18.40	18.50	18.40	18.46	0.16
4	03/05/21 11:46	70.50	70.10	70.10	70.10	70.20	70.10	70.12	-0.38
5	03/07/11 09:57	25.80	26.00	26.00	26.00	26.00	26.00	26.00	0.20
6	03/07/11 11:01	62.00	62.20	62.20	62.20	62.20	62.20	62.20	0.20
7	03/07/27 15:00	24.90	24.90	24.80	24.80	24.80	24.80	24.82	-0.08
8	03/07/27 16:10	60.30	60.20	60.30	60.20	60.30	60.20	60.24	-0.06
9	03/09/19 08:34	26.40	26.30	26.40	26.40	26.40	26.30	26.36	-0.04
10	03/09/19 09:44	71.20	71.40	71.40	71.40	71.40	71.40	71.40	0.20

Point no.: 588 Tag no.: S1-IN-T2 Tag name: S1-INLET-T2 Ch.no.: 22 Unit: ℃

No.	日付 Date 時刻 Time	基準値 Standard Value	1	2	3	4	5	平均 Ave.	精度 Accuracy ℃
1	03/02/27 15:55	15.50	15.30	15.40	15.30	15.40	15.30	15.34	-0.16
2	03/02/27 17:54	80.00	80.00	79.90	79.90	79.90	80.00	79.94	-0.06
3	03/05/21 10:13	18.30	18.10	18.10	18.10	18.10	18.10	18.10	-0.20
4	03/05/21 11:46	70.50	70.30	70.20	70.20	70.20	70.30	70.24	-0.26
5	03/07/11 09:57	25.80	25.60	25.50	25.60	25.60	25.60	25.58	-0.22
6	03/07/11 11:01	62.00	61.80	61.70	61.80	61.80	61.70	61.76	-0.24
7	03/07/27 15:00	24.90	24.80	24.70	24.80	24.70	24.80	24.76	-0.14
8	03/07/27 16:10	60.30	60.20	60.20	60.20	60.20	60.20	60.20	-0.10
9	03/09/19 08:34	26.40	26.50	26.40	26.40	26.40	26.50	26.44	0.04
10	03/09/19 09:44	71.20	71.10	71.00	71.00	71.10	71.00	71.04	-0.16

INSPECTION TEAM
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S.SUZUKI 03/09/19

キャリブレーション記録（ＨＢ測温抵抗体）

CALIBRATION RECORD (RTD) (2/2)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

Point no.: 589 Tag no.: S1-IN-T3 Tag name: S1-INLET-T3 Ch.no.: 23 Unit: ℃

No.	日付 Date 時刻 Time	基準値 Standard Value	1	2	3	4	5	平均 Ave.	精度 Accuracy ℃
1	03/02/27 15:55	15.50	15.50	15.70	15.50	15.70	15.50	15.58	0.08
2	03/02/27 17:55	80.50	80.40	80.40	80.40	80.40	80.40	80.40	-0.10
3	03/05/21 10:13	18.30	18.20	18.20	18.20	18.30	18.30	18.24	-0.06
4	03/05/21 11:46	70.50	70.70	70.70	70.70	70.70	70.70	70.70	0.20
5	03/07/11 09:57	25.80	26.00	26.00	26.00	26.00	26.00	26.00	0.20
6	03/07/11 11:01	62.00	61.80	61.90	61.90	61.90	61.90	61.88	-0.12
7	03/07/27 15:00	24.90	25.20	25.00	25.20	25.10	25.20	25.14	0.24
8	03/07/27 16:10	60.30	60.50	60.60	60.50	60.60	60.50	60.54	0.24
9	03/09/19 08:34	26.40	26.30	26.30	26.30	26.40	26.30	26.32	-0.08
10	03/09/19 09:44	71.20	71.30	71.30	71.30	71.30	71.30	71.30	0.10

Point no.: 590 Tag no.: S1-IN-T4 Tag name: S1-INLET-T4 Ch.no.: 24 Unit: ℃

No.	日付 Date 時刻 Time	基準値 Standard Value	1	2	3	4	5	平均 Ave.	精度 Accuracy ℃
1	03/02/27 15:55	15.50	15.50	15.50	15.50	15.50	15.50	15.50	0.00
2	03/02/27 17:55	80.50	80.40	80.30	80.40	80.30	80.40	80.36	-0.14
3	03/05/21 10:13	18.30	18.50	18.30	18.40	18.20	18.40	18.36	0.06
4	03/05/21 11:46	70.50	70.80	70.90	70.80	70.80	70.80	70.82	0.32
5	03/07/11 09:57	25.80	26.00	26.00	26.00	26.00	26.00	26.00	0.20
6	03/07/11 11:01	62.00	62.10	62.10	62.10	62.10	62.10	62.10	0.10
7	03/07/27 15:00	24.90	25.10	25.00	25.10	25.00	25.10	25.06	0.16
8	03/07/27 16:10	60.30	60.20	60.20	60.20	60.20	60.20	60.20	-0.10
9	03/09/19 08:34	26.40	26.50	26.50	26.50	26.40	26.50	26.48	0.08
10	03/09/19 09:44	71.20	71.40	71.40	71.30	71.40	71.40	71.38	0.18

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S.SUZUKI 3/ 9/19

キャリブレーション記録（HB測温抵抗体） 56

CALIBRATION RECORD (RTD) (1/1)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

Point no.: 575 Tag no.: O1-UP-T1 Tag name:01-UPSTREAM-T1 Ch.no.: 26 Unit: ℃

No.	日付 Date 時刻 Time	基準値 Standard Value	1	2	3	4	5	平均 Ave.	精度 Accuracy ℃
1	03/02/27 15:57	15.50	15.50	15.50	15.50	15.50	15.50	15.50	0.00
2	03/02/27 17:56	80.30	80.40	80.40	80.40	80.40	80.40	80.40	0.10
3	03/05/21 10:59	18.60	18.70	18.50	18.80	18.80	18.70	18.70	0.10
4	03/05/21 12:48	70.60	70.50	70.60	70.80	70.60	70.70	70.64	0.04
5	03/07/11 09:59	25.40	25.30	25.30	25.30	25.40	25.30	25.32	-0.08
6	03/07/11 11:32	61.30	61.40	61.40	61.40	61.40	61.30	61.38	0.08
7	03/07/27 15:07	24.70	24.50	24.70	24.50	24.60	24.50	24.56	-0.14
8	03/07/27 15:50	60.10	60.10	60.10	60.20	60.20	60.20	60.16	0.06
9	03/09/19 08:36	26.40	26.40	26.40	26.40	26.40	26.30	26.38	-0.02
10	03/09/19 09:51	71.20	71.00	71.00	71.00	71.00	71.00	71.00	-0.20

Point no.: 576 Tag no.: O1-UP-T2 Tag name:01-UPSTREAM-T2 Ch.no.: 27 Unit: ℃

No.	日付 Date 時刻 Time	基準値 Standard Value	1	2	3	4	5	平均 Ave.	精度 Accuracy ℃
1	03/02/27 15:57	15.50	15.30	15.50	15.40	15.50	15.40	15.42	-0.08
2	03/02/27 17:56	80.30	80.10	80.20	80.10	80.20	80.10	80.14	-0.16
3	03/05/21 10:59	18.60	18.40	18.40	18.40	18.40	18.40	18.40	-0.20
4	03/05/21 12:48	70.60	70.70	70.70	70.70	70.70	70.60	70.68	0.08
5	03/07/11 09:59	25.40	25.20	25.20	25.20	25.20	25.20	25.20	-0.20
6	03/07/11 11:32	61.30	61.30	61.40	61.40	61.30	61.40	61.36	0.06
7	03/07/27 15:07	24.70	24.60	24.60	24.50	24.70	24.50	24.58	-0.12
8	03/07/27 16:39	60.10	60.10	60.10	60.10	60.10	60.10	60.10	0.00
9	03/09/19 08:36	26.40	26.40	26.50	26.40	26.50	26.40	26.44	0.04
10	03/09/19 09:51	71.20	71.30	71.30	71.30	71.30	71.20	71.28	0.08

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S.SUZUKI 03/09/19

キャリブレーション記録（HB測温抵抗体）

57

CALIBRATION RECORD (RTD) (1/2)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

Point no.: 595 Tag no.: S1-DI-T1 Tag name: S1-DISCH-T1 Ch.no.: 31 Unit: ℃

No.	日付 Date 時刻 Time	基準値 Standard Value	1	2	3	4	5	平均 Ave.	精度 Accuracy ℃
1	02/02/20 15:16	89.50	89.70	89.60	89.60	89.60	89.70	89.64	0.14
2	02/02/20 17:04	150.30	150.40	150.40	150.20	150.40	150.40	150.36	0.06
3	02/05/11 11:32	16.20	15.90	15.90	16.00	15.90	16.00	15.94	-0.26
4	02/05/11 12:52	69.80	69.80	69.90	69.80	69.90	69.80	69.84	0.04
5	02/05/11 14:25	119.80	119.60	119.70	119.60	119.80	119.70	119.68	-0.12
6	02/05/11 16:02	179.00	178.90	179.10	179.10	179.10	178.90	179.02	0.02
7	03/02/03 16:11	69.80	70.00	70.10	70.10	70.10	70.10	70.08	0.28
8	03/02/04 10:50	159.50	159.60	159.50	159.60	159.50	159.60	159.56	0.06
9	03/09/19 08:54	51.00	51.00	51.00	51.00	51.10	51.10	51.04	0.04
10	03/09/19 10:52	119.60	119.70	119.70	119.70	119.70	119.70	119.70	0.10

Point no.: 596 Tag no.: S1-DI-T2 Tag name: S1-DISCH-T2 Ch.no.: 32 Unit: ℃

No.	日付 Date 時刻 Time	基準値 Standard Value	1	2	3	4	5	平均 Ave.	精度 Accuracy ℃
1	02/02/20 15:16	89.50	89.70	89.70	89.70	89.70	89.70	89.70	0.20
2	02/02/20 17:04	150.30	150.40	150.40	150.40	150.40	150.40	150.40	0.10
3	02/05/11 11:32	16.20	16.10	16.10	16.10	16.10	16.10	16.10	-0.10
4	02/05/11 12:52	69.80	69.70	69.70	69.70	69.70	69.80	69.72	-0.08
5	02/05/11 14:25	119.80	119.70	119.70	119.70	119.80	119.70	119.72	-0.08
6	02/05/11 16:02	179.00	179.10	178.90	178.90	179.10	179.10	179.02	0.02
7	03/02/03 16:11	69.80	70.10	70.10	70.10	70.20	70.00	70.10	0.30
8	03/02/04 10:50	159.50	159.50	159.40	159.50	159.40	159.40	159.44	-0.06
9	03/09/19 08:54	51.00	50.90	50.90	50.90	50.90	50.90	50.90	-0.10
10	03/09/19 10:52	119.60	119.40	119.50	119.50	119.70	119.50	119.52	-0.08

INSPECTION TEAM
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LG E&C

御立会者 WITNESSED BY 日付 DATE

審査 TEST ENGINEER 日付 DATE

S. SUZUKI 03/09/19

キャリブレーション記録（ＨＢ測温抵抗体）58

CALIBRATION RECORD (RTD) (2/2)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

Point no.: 597 Tag no.: S1-DI-T3 Tag name: S1-DISCH-T3 Ch.no.: 33 Unit: ℃

No.	日付 Date 時刻 Time	基準値 Standard Value	1	2	3	4	5	平均 Ave.	精度 Accuracy ℃
1	02/02/20 15:16	89.50	89.70	89.70	89.70	89.70	89.70	89.70	0.20
2	02/02/20 17:04	150.30	150.10	150.50	150.10	150.20	150.60	150.30	0.00
3	02/05/11 11:32	16.20	15.90	15.90	15.90	15.80	15.90	15.88	-0.32
4	02/05/11 12:53	69.40	69.50	69.30	69.40	69.30	69.40	69.38	-0.02
5	02/05/11 14:27	119.50	119.50	119.40	119.50	119.50	119.50	119.48	-0.02
6	02/05/11 16:04	178.70	178.70	178.60	178.70	178.70	178.70	178.68	-0.02
7	03/02/03 16:11	69.80	70.10	70.10	70.10	70.10	70.10	70.10	0.30
8	03/02/04 10:50	159.50	159.50	159.40	159.50	159.40	159.50	159.46	-0.04
9	03/09/19 08:54	51.00	50.90	51.00	50.90	50.90	50.90	50.92	-0.08
10	03/09/19 10:52	119.60	119.50	119.50	119.70	119.50	119.70	119.58	-0.02

Point no.: 598 Tag no.: S1-DI-T4 Tag name: S1-DISCH-T4 Ch.no.: 34 Unit: ℃

No.	日付 Date 時刻 Time	基準値 Standard Value	1	2	3	4	5	平均 Ave.	精度 Accuracy ℃
1	02/02/20 15:16	89.50	89.50	89.50	89.40	89.50	89.50	89.48	-0.02
2	02/02/20 17:04	150.30	150.20	150.20	150.10	150.20	150.40	150.22	-0.08
3	02/05/11 11:45	16.20	16.20	16.10	16.20	16.10	16.10	16.14	-0.06
4	02/05/11 12:53	69.80	69.80	69.90	69.80	69.80	69.90	69.84	0.04
5	02/05/11 14:29	119.80	119.70	119.60	119.80	119.70	119.80	119.72	-0.08
6	02/05/11 16:05	179.00	178.90	179.00	178.90	179.00	179.00	178.96	-0.04
7	03/02/03 16:11	69.80	69.80	69.80	69.70	69.80	69.80	69.78	-0.02
8	03/02/04 10:50	159.50	159.50	159.40	159.40	159.40	159.50	159.44	-0.06
9	03/09/19 08:54	51.00	51.10	51.10	51.10	51.10	51.10	51.10	0.10
10	03/09/19 10:52	119.60	119.70	119.70	119.70	119.70	119.70	119.70	0.10

LG E&C INSPECTION TEAM ☐ WITNESSED ☑ REVIEWED

御立会者 WITNESSED BY 日付 DATE

審査 TEST ENGINEER 日付 DATE

S.SUZUKI 3/ 9/19

計器検定成績書
INSTRUMENT TEST CERTIFICATE

管理番号
Manage No. 94H3725−5

型式
Type デジタル回転計 TM-820

測定範囲
Range 0 ～ 99999min-1

最大許容差 Tolerance of Accuracy	3 Hz ～ 20 kHz	表示値 X (±0.02%) ± 1digit
	1 Hz ～ 3 Hz	表示値 X (±0.15%) ± 1digit
	0.1 Hz ～ 1 Hz	表示値 X (±0.08%) ± 1digit

基準器
Standard Instrument

型式 Type	FS-121A Digital Synthesizer	管理番号 Manage No.	SG−(1)-015

試験状態
Test Conditions

室温
Ambient Temp. 21℃

入力信号 7200 シリーズ

Frequency Input 入力周波数 (Hz)	Data 計測回転数 (r/min)	Result 校正結果
0.1	6	Acceptable 合格
10	600	
100	6000	
1000	60000	
1600	96000	

入力信号 MP-910
入力パルス数:60P/R 分周設定:60P/R

Frequency Input 入力周波数 (Hz)	Data 計測回転数 (r/min)	Result 校正結果
200	200	Acceptable 合格
1000	999	
10000	9999	
20000	20000	

入力信号 MP-981·LG-916
入力パルス数:60P/R 分周設定:60P/R

Frequency Input 入力周波数 (Hz)	Data 計測回転数 (r/min)	Result 校正結果
6	6	Acceptable 合格
10	10	
100	100	
1000	999	
10000	9999	
20000	19999	

INSPECTION TEAM
☐ WITNESSED ☑ REVIEWED
L.C. E&C

試験者 Tested By S.Suzuki

試験日 Date '03/3/5

EBARA

EBARA CORPORATION

PM10U

計器検定成績書
INSTRUMENT TEST CERTIFICATE

管理番号
Manage No. 3336A55551

型式
Type ガスクロマトグラフ Gas Chromatograph

測定範囲
Range 5 種混合ガス Gas Mixture

最大許容差
Tolerance of Accuracy ≦5%

基準器
Standard Instrument

型式
Type 5 種混合ガス

管理番号
Manage No. 5K-25275

試験状態
Test Conditions

室温
Ambient Temp. 26℃

Table 2.1 Freon-134a ESTD

	CO2		He		O2		N2		F-134a	
	RT	Area	RT	Area	RT	Area	RT	Area	RT	Area
1	4.109	6467	5.376	43565	6.904	7848	7.961	5983	13.812	8020
2	4.122	6410	5.372	43576	6.898	7817	7.954	5931	13.831	8208
3	4.105	6428	5.365	43447	6.887	7721	7.938	5902	13.815	8025
4	4.095	6400	5.365	43430	6.888	7792	7.94	5890	13.803	8234
5										
Ave.	4.10775	6426.25	5.3695	43504.5	6.89425	7794.5	7.94825	5926.5	13.8153	8121.75
STD.	0.0112	29.5339	0.0054	76.6572	0.0082	54.0894	0.0111	41.4126	0.0117	115.1126
%RSD	0.2721	0.4596	0.1014	0.1762	0.1187	0.6939	0.1395	0.6988	0.0845	1.4173

LG E&C
INSPECTION TEAM
☐ WITNESSED ☑ REVIEWED

試験結果 : 合格
Test Result : Acceptable

試験者 Tested By Y. Kumada
試験日 Date '03/9/18

EBARA
EBARA CORPORATION

PM10U

2003年 7月31日

ガス分析試験成績書

No. 1-07-0490-0

御注文先

㈱荏原エリオット 殿

高千穂化學工業㈱
〒194-0004 東京都町田市鶴間1-6 5 7番地
電話042-796-5501 FAX042-795-7168

試料名	容器番号
Gas Mixture	3K -32732

試験方法	GAS CHROMATOGRAPHY

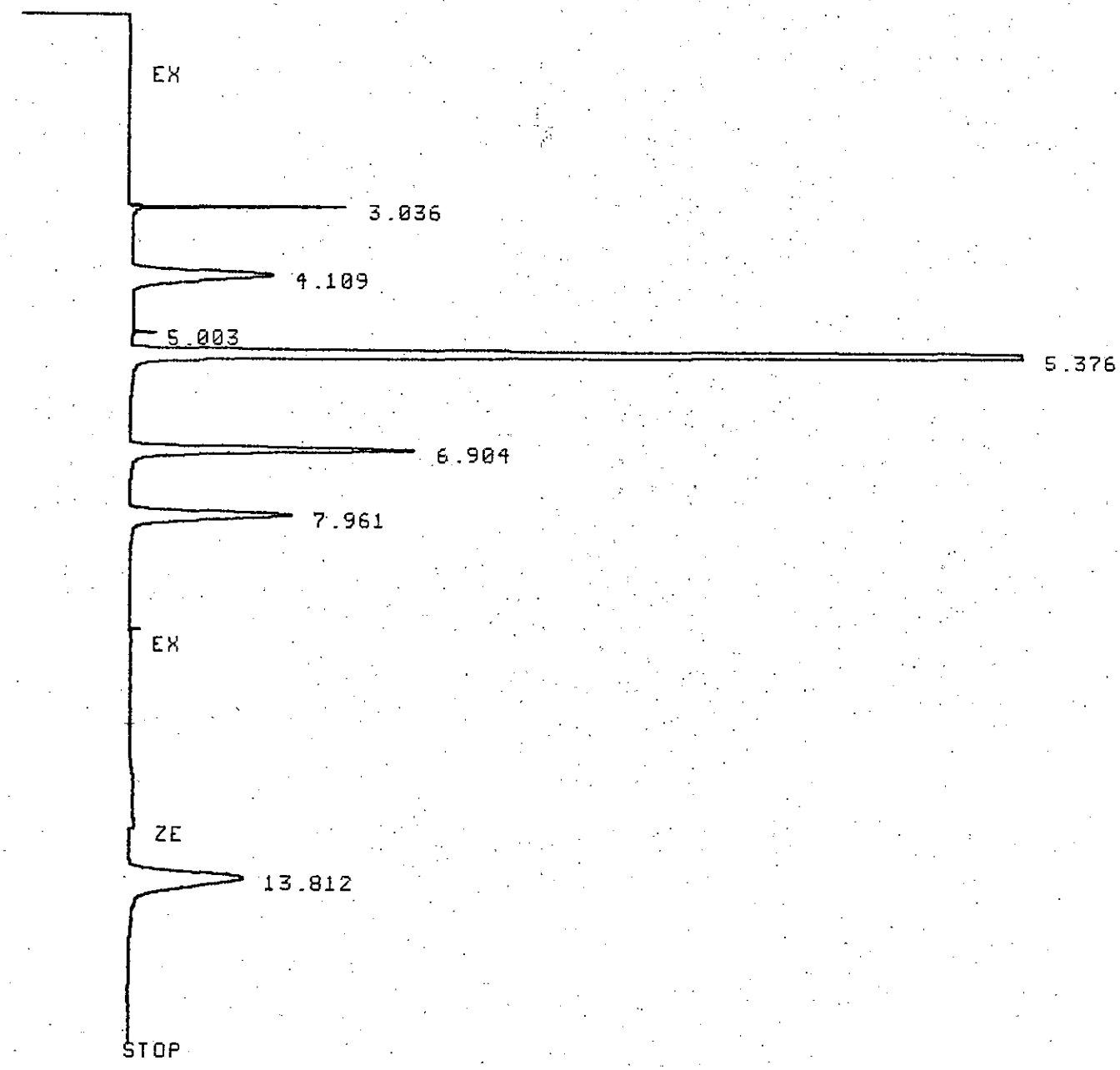
試験結果	ガス名	分析 値	分析 単位	仕様
	OXYGEN	19.8	%	20
	CARBON DIOXIDE	20.2	%	20
	1,1,1,2-TETRAFLUORO ETHANE	19.9	%	20
	HELIUM	21.0	%	20
	NITROGEN	BALANCE		

LG E&C INSPECTION TEAM ☐ WITNESSED ☑ REVIEWED

充填日	2003	7.19
充填量	0.25	MPa
容器種類	10 L	

試験日	室内温度	試験者	係長	課長
2003年 7月30日	20 ℃			

* RUN # 205 SEP 18, 2003 08:32:34 EX



Closing signal file M:SIGNAL .BNC

RUN# 205 SEP 18, 2003 08:32:34

SAMPLE# 170

METHOD NAME: M*FREON.MET

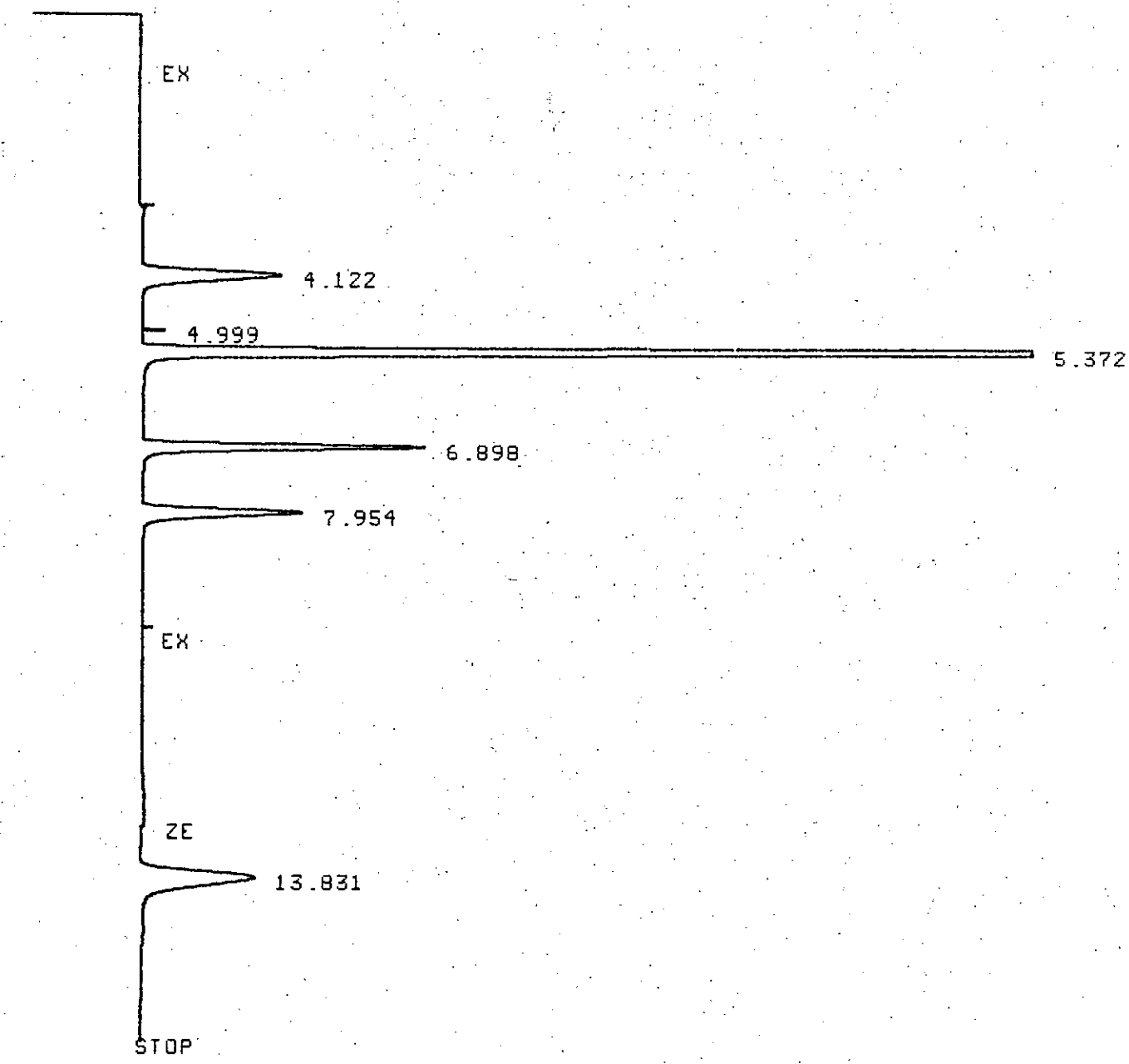
SIGNAL FILE: M:SIGNAL.BNC
NORM-AREA

RT	TYPE	AREA	WIDTH	CAL#	%	NAME
4.109	PB	6467	.178	1R	21.472	CO2
5.376	PB	43565	.091	2R	19.188	He
6.904	PB	7848	.108	3R	19.789	O2
7.961	BB	5983	.144	4R	20.159	N2
13.812	PB	8020	.274	5R	19.393	Freon-134a

TOTAL AREA= 72837
MUL FACTOR=1.0000E+00

INSPECTION TEAM
☐ WITNESSED ☑ REVIEWED
LG E&C

* RUN # 206 SEP 18, 2003 08:58:34 EX



Closing signal file M:SIGNAL .BNC

RUN# 206 SEP 18, 2003 08:58:34

SAMPLE# 170

METHOD NAME: M*FREON.MET

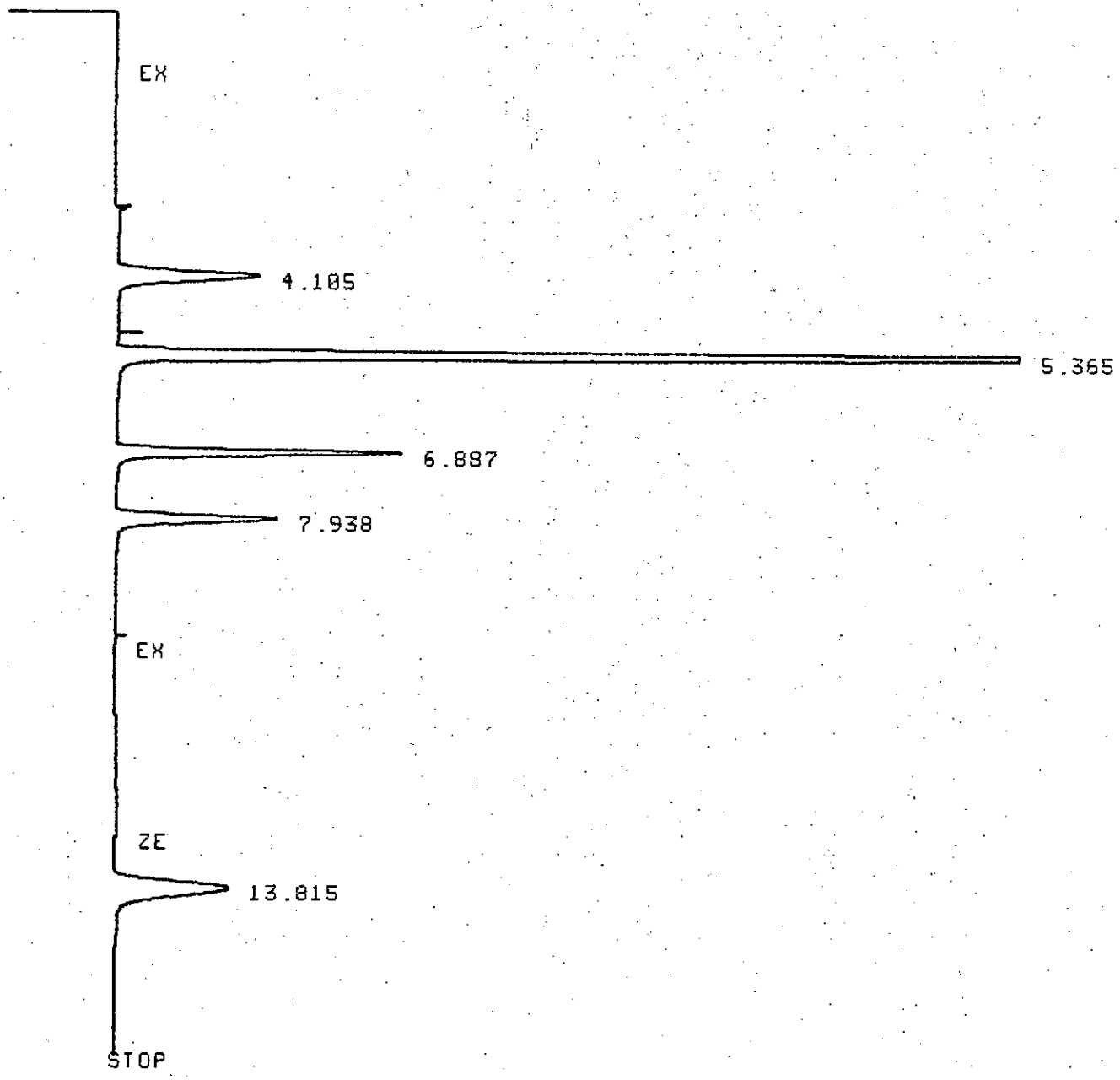
INSPECTION TEAM
☐ WITNESSED ☑ REVIEWED
LG E&C

SIGNAL FILE: M:SIGNAL.BNC
NORM-AREA

RT	TYPE	AREA	WIDTH	CAL#	%	NAME
4.122	PB	6410	.178	1R	20.582	CO2
5.372	PB	43576	.091	2R	20.879	He
6.898	PB	7817	.108	3R	19.735	O2
7.954	BB	5931	.144	4R	18.878	N2
13.831	PB	8208	.277	5R	19.926	Freon-134a

TOTAL AREA= 72027
MUL FACTOR=1.0000E+00

* RUN # 207 SEP 18, 2003 09:50:37 EX



Closing signal file M:SIGNAL .BNC

RUN# 207 SEP 18, 2003 09:50:37

SAMPLE# 170

METHOD NAME: M*FREON.MET

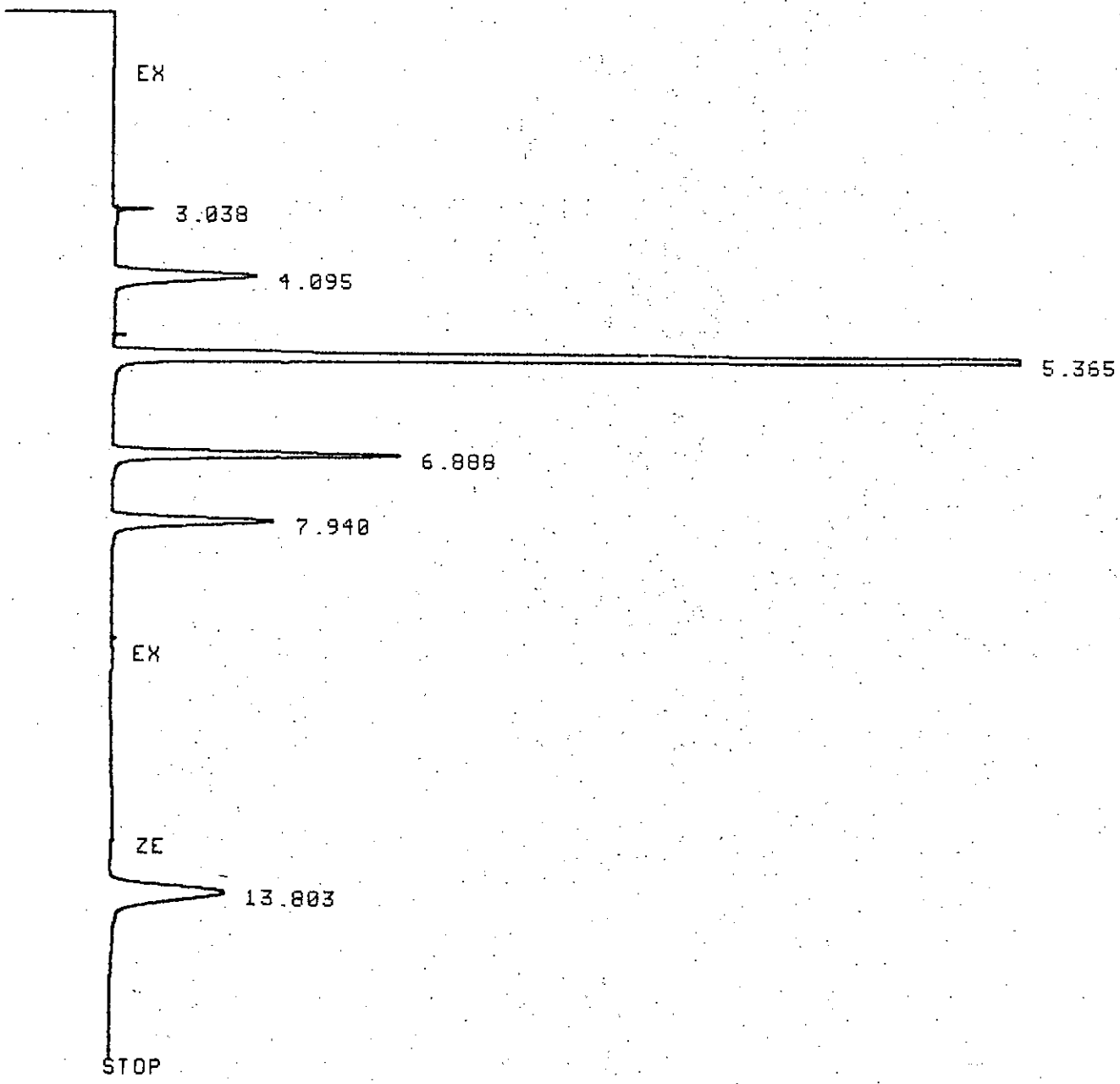
SIGNAL FILE: M:SIGNAL.BNC
NORM-AREA

RT	TYPE	AREA	WIDTH	CAL#	%	NAME
4.105	PB	6428	.178	1R	20.417	CO2
5.365	BB	43447	.091	2R	21.103	He
6.887	BB	7721	.107	3R	19.712	O2
7.938	PB	5902	.144	4R	19.157	N2
13.815	PB	8025	.274	5R	19.610	Freon-134a

TOTAL AREA= 71523
MUL FACTOR=1.0000E+00

INSPECTION TEAM
☐ WITNESSED ☑ REVIEWED
LG E&C

* RUN # 208 SEP 18, 2003 13:02:57 EX



Closing signal file M:SIGNAL .BNC

RUN# 208 SEP 18, 2003 13:02:57

SAMPLE# 170

METHOD NAME: M*FREON.MET

SIGNAL FILE: M:SIGNAL.BNC

NORM-AREA

RT	TYPE	AREA	WIDTH	CAL#	%	NAME
4.095	PU	6400	.177	1R	20.080	CO2
5.365	BB	43430	.092	2R	20.941	He
6.888	PB	7792	.108	3R	19.783	O2
7.940	BB	5890	.143	4R	18.936	N2
13.803	PU	8234	.282	5R	20.260	Freon-134a

TOTAL AREA= 71963

MUL FACTOR=1.0000E+00

LG E&C	INSPECTION TEAM ☐ WITNESSED ☑ REVIEWED

TITLE	Mechanical Running Test Report	DOC.No. 8214-S3T151	REV. 0
CUSTOMER	LG Engineering & Construction Corp.	COMPLETE IN WITH COVER 60	SHEETS
FINAL USER	Turkish Petroleum Refineries Corp.		
PROJECT	Tupras Izmir Refinery DHP Project	SERVICE	Recycle Compressor
JOB No.	7020	EBARA SER.No.	R021570803
			R021570802
ITEM No.	TC-9901	MODEL/EQUIP.	SRV-5DF SET 1
	CT-9901		25MB5 SET 1
			SET

Note : This report is for B (Job) Rotor.

LG E&C INSPECTION TEAM ☑WITNESSED ☐REVIEWED Oct. 15, 2003

☐ FOR APPROVAL	☐
AVOID DELAY TO MAINTAIN SHIPPING PROMISE. ONE APPROVED PRINT MUST BE RETURNED BY: _____	ANY REQUESTED CHANGE OF THIS EQUIPMENT WILL RESULT IN: 1.CONTRACT PRICE ADJUSTMENT 2.EXTENDED SHIPPING PROMISE AS THIS CONTRACT IS IN MANUFACTURING PROCESS.
BY: _____ DATE: _____	BY: _____ DATE: _____

TO SET
CUS. 1R

Issued by
Test Engineering Section

APPROVED BY H. Ishikawa Oct 15 '03

CHECKED BY

PREPARED BY T. Suzuki Oct 15 '03

REV.	PAGE	DATE	APP'D	BY
5				
4				
3				
2				
1				

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

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LG E&C
INSPECTION TEAM
☑WITNESSED ☐REVIEWED
Oct. 15, 2003

1.1 SUMMARY OF TEST RESULT (COMPRESSOR)

SO No.	: R021570802	Item No	: CT-9901
Model	: 25MB5	Rotor	: B (Job)

Item	Acceptance Criteria	Test Result		
Shaft Vibration	25.0 μm p-p @ MCS	MAX.	6.7	μm p-p
	150% of recorded value @MCS @ OVS	MAX.	7.1	μm p-p
Vibration Sweep	Non Synchro. Freq. Vib. 5.0 μm p-p	MAX.	1.509	μm p-p
Critical Speed	.		4721.	rpm
Amprification Factor	Formula : AF=Nc1/(N2-N1)	AF=	3.93	
	AF<2.5 : No Separation Margin Required.	.	NC1=	4721.
	2.5≦AF<3.55 : 5% Blow Minimum Speed	.	N1=	4228.
	3.5≦AF : SM≧100-(84+6/(AF-3)) [%]	<---	N2=	5428.
Separation Margin	(Nmin - Nc1) / Nmin =	Actual	34.6%	
		Specified	9.6%	
	(Nmin = 7218.)	Acceptable		
Lube Oil Drain Temp.	@MCS ΔT≦ 28 ℃	Max.	23.9	℃
Lube Oil Supply Flow	(Test Condition Target Value : 178. lit/min.) @MCS	Max.	179.	lit/min.
Bearing Metal Temp.	@MCS ≦127℃	Max.	94.1	℃
Primary Seal Gas Leak.	@MCS (See H8 of Test Proc.) 1st measurement		0.51	Lit./Min./ Machine
	2nd measurement		0.47	
Bearing Performance	Stable Rotor - Bearing System		Good	
Outward Oil Leakage	No Leakage		No Leakage	
Sound Level	Reference only (around 25MB5)	Max.	83	dBA

Test result **Acceptable**

LG E&C INSPECTION TEAM ☑WITNESSED ☐REVIEWED Oct. 15, 2003

Test Date 15-Oct-03 Test Engineer N.Ishikawa

1.2 SUMMARY OF TEST RESULT (TURBINE)

SO No. : R021570803 Item No : TC-9901

Model : SRV-5DF Rotor : B (Job)

Item	Acceptance Criteria	Test Result		
Shaft Vibration	25.0 μm p-p @ MCS	MAX.	9.8	μm p-p
	150% of recorded value @MCS @ OVS	MAX.	13.5	μm p-p
Vibration Sweep	Non Synchro. Freq. Vib. 5.0 μm p-p	MAX.	1.081	μm p-p
Critical Speed	.		3997.	rpm
Amprification Factor	Formula : AF=Nc1/(N2-N1)	AF=	4.19	
	AF<2.5 : No Separation Margin Required.	.	NC1=	3997.
	2.5≦AF<3.55 : 5% Blow Minimum Speed	.	N1=	3652.
	3.5≦AF : SM≧100-(84+6/(AF-3)) [%]	<——	N2=	4605.
Separation Margin	(Nmin - Nc1) / Nmin =	Actual	44.6%	
		Specified	11.0%	
	(Nmin = 7218.)	Acceptable		
Lube Oil Drain Temp.	@MCS ΔT≦ 28 ℃	Max.	24.8	℃
Lube Oil Supply Flow	(Test Condition Target Value : 178. lit/min.) @MCS	Max.	179.	lit/min.
Bearing Metal Temp.	@MCS ≦127℃	Max.	100.0	℃
Remote Trip Test	-		Good	
Overspeed Trip Test	11792 - 12030 rpm (elec.)	1st	11910.	rpm
		2nd	-	rpm
		3rd	-	rpm
Speed Control	7218 - 10828 rpm		Good	
Steam Tightness	No Leakage		No Leakage	
Manual Excercise	Smooth Operation		Good	
Bearing Performance	Stable Rotor - Bearing System		Good	
Outward Oil Leakage	No Leakage		No Leakage	
Sound Level	Reference only (around SRV-5DF)	Max.	83	dBA
Turning Motor Operation	Smooth Operation		Good	

Test result **Acceptable**

H. Nishikawa

Test Date 15-Oct-03 Test Engineer Nishikawa

ELLIOTT EBARA GROUP

INSPECTION TEAM ☑WITNESSED ☐REVIEWED LG E&C Oct. 15, 2003

Elliott Ebara Turbomachinery Corporation

2 Record for Compressor

2-1 Running Test Record

Period		
10:08	to 16:07	Normal Mechanical Running Test
11:27	to 11:42	Over Speed Running
11:45	to 15:45	4hours Running at MCS
		*Bearing Performance Test
13:06	to 13:21	Lube Oil Supply Temp. = 43 ℃
		Lube Oil Supply Press. = 1.27kg/cm2G
13:43	to 13:58	Lube Oil Supply Temp. = 49 ℃
		Lube Oil Supply Press. = 1.05kg/cm2G

LG E&C | INSPECTION TEAM ☑WITNESSED ☐REVIEWED Oct. 15, 2003

コンプレッサ運転記録

COMPRESSOR RUNNING TEST RECORD (1/3)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

回転方向（駆動側から見て） DIRECTION OF ROTATION (facing drive end) : 時計 CW

ロータ ROTOR : B B

起動 START 10:08 停止 STOP 16:07

時刻 TIME	回転数 SPEED min⁻¹	軸振動 SHAFT VIBRATION (μm p-p) 駆動側 DRIVE END CH. NO 16	駆動側 DRIVE END CH. NO 15	反駆動側 OP DRIVE END CH. NO 18	反駆動側 OP DRIVE END CH. NO 17	軸移動量 1 AXIAL DISP.1 mm	軸移動量 2 AXIAL DISP.2 mm	吸込圧力 INLET PRESS kgf/cm²G	吐出圧力 DISCH. PRESS kgf/cm²G	平衡室圧力 BALANCE CHAM. PRESS kgf/cm²G	バッファガス圧力 BUFFER GAS PRESS kgf/cm²G	バッファガス差圧 BUFFER DIFF. PRESS kgf/cm²D
9:35	0	------	------	------	------	-0.05	-0.05	0.30	0.30	0.30	0.32	0.02
10:07	20	------	------	------	------	-0.05	-0.06	-0.98	-0.99	-0.99	0.60	1.59
10:16	1024	6.3	5.6	5.3	5.1	-0.01	-0.02	-0.98	-0.98	-0.99	0.58	1.57
10:36	2956	5.6	5.4	4.6	4.6	0.02	0.01	-0.97	-0.97	-0.99	0.49	1.48
10:49	7213	4.9	4.5	4.2	4.1	0.03	0.02	-0.97	-0.96	-0.99	0.56	1.55
10:59	10828	5.8	5.6	4.7	4.6	-0.00	-0.02	-0.97	-0.95	-0.99	0.50	1.49
11:03	11904	6.6	6.2	4.8	4.7	-0.01	-0.02	-0.97	-0.95	-0.99	0.50	1.50
11:09	7219	5.3	5.1	4.3	4.2	0.04	0.03	-0.96	-0.95	-0.99	0.43	1.42
11:14	8127	5.2	5.0	4.3	4.1	0.04	0.02	-0.96	-0.95	-0.99	0.47	1.46
11:16	9022	5.4	4.8	4.5	4.1	0.04	0.01	-0.96	-0.95	-0.99	0.47	1.46
11:18	9922	5.4	5.0	4.2	4.1	0.03	0.01	-0.96	-0.95	-0.99	0.43	1.42
11:21	10826	5.7	5.4	4.3	4.2	0.02	-0.01	-0.96	-0.95	-0.99	0.44	1.43
11:27	11789	6.7	6.3	4.8	4.7	-0.00	-0.02	-0.96	-0.94	-0.99	0.37	1.37
11:42	11788	7.1	6.9	5.0	4.9	0.00	-0.03	-0.96	-0.94	-0.99	0.47	1.46
11:45	10826	6.6	6.4	4.8	4.7	0.03	-0.01	-0.96	-0.94	-0.99	0.49	1.48
12:00	10827	6.3	6.0	4.5	4.5	0.02	-0.00	-0.96	-0.94	-0.99	0.55	1.54
12:15	10824	6.2	5.9	4.5	4.4	0.03	0.01	-0.96	-0.93	-0.99	0.52	1.51

一次危険速度 FIRST CRITICAL SPEED 4721 min⁻¹

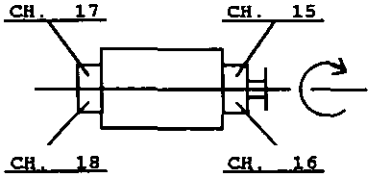
外部油漏れ OUTWARD OIL LEAKAGE 合格 NO LEAK

プライマリシール漏れ量 PRIMARY SEAL LEAKAGE (Lit/min)	時刻 TIME	12:49	14:45
	駆動側 DRIVE END	0.28	0.25
	反駆動側 OP DRIVE END	0.23	0.22

Lube Oil Flow
① 12:49 179 Lit/min
② 14:45 176 Lit/min

[記事 NOTES]

1. 油 OIL : ISO VG#32
2. コンプレッサ軸中心と油圧力計との高さの差
   Differential head between the compressor centerline and the oil pressure gauge = 0.00 m, 0.00 kgf/cm²G
3. 軸振動計器番号 上から見て
   Vibration channel No. ---- plan view.



INSPECTION TEAM ☑WITNESSED ☐REVIEWED Oct. 15, 2003 LG E&C

御立会者 WITNESSED BY 日付 DATE

審査 TEST ENGINEER 日付 DATE

N.ISHIKAWA 03/10/15

記録 RECORDED BY 日付 DATE

T.NISHIYAMA 03/10/15

コンプレッサ運転記録

7

COMPRESSOR RUNNING TEST RECORD (1/3)

PAGE : 2

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

回転方向（駆動側から見て） DIRECTION OF ROTATION (facing drive end) : 時計 CW

ロータ ROTOR : B B

起動 START 10:08 停止 STOP 16:07

時刻 TIME	回転数 SPEED min⁻¹	軸振動 SHAFT VIBRATION (μm p-p) 駆動側 DRIVE END CH. NO 16	駆動側 DRIVE END CH. NO 15	反駆動側 OP.DRIVE END CH. NO 18	反駆動側 OP.DRIVE END CH. NO 17	軸移動量 1 AXIAL DISP.1 mm	軸移動量 2 AXIAL DISP.2 mm	吸込圧力 INLET PRESS kgf/cm²G	吐出圧力 DISCH. PRESS kgf/cm²G	平衡室圧力 BALANCE CHAM. PRESS kgf/cm²G	バッファガス圧力 BUFFER GAS PRESS kgf/cm²G	バッファガス差圧 BUFFER DIFF. PRESS kgf/cm²D
12:30	10828	6.2	5.9	4.4	4.4	0.02	-0.01	-0.96	-0.93	-0.99	0.52	1.50
12:45	10828	6.1	5.8	4.4	4.3	0.04	0.01	-0.95	-0.93	-0.99	0.53	1.51
13:00	10828	5.9	5.6	4.3	4.2	0.03	0.01	-0.95	-0.93	-0.99	0.52	1.50
13:06	10828	5.8	5.5	4.2	4.1	0.04	0.02	-0.95	-0.93	-0.99	0.56	1.55
13:15	10827	5.8	5.5	4.2	4.1	0.04	0.02	-0.95	-0.93	-0.99	0.52	1.50
13:21	10828	5.8	5.5	4.2	4.1	0.04	0.01	-0.95	-0.93	-0.99	0.51	1.50
13:30	10825	6.0	5.6	4.2	4.1	0.05	0.02	-0.95	-0.93	-0.98	0.54	1.52
13:43	10826	6.5	6.1	4.5	4.4	0.04	0.02	-0.95	-0.93	-0.98	0.52	1.50
13:45	10825	6.5	6.1	4.5	4.5	0.04	0.01	-0.95	-0.93	-0.98	0.53	1.51
13:58	10826	6.7	6.2	4.6	4.5	0.04	0.02	-0.95	-0.92	-0.98	0.51	1.49
14:00	10827	6.7	6.2	4.6	4.5	0.04	-0.00	-0.95	-0.92	-0.98	0.52	1.51
14:15	10828	6.2	5.8	4.4	4.3	0.04	0.01	-0.95	-0.92	-0.98	0.49	1.48
14:30	10828	6.1	5.7	4.3	4.3	0.04	0.02	-0.95	-0.92	-0.98	0.55	1.54
14:45	10827	6.1	5.7	4.3	4.2	0.03	0.01	-0.95	-0.92	-0.98	0.48	1.46
15:00	10827	6.1	5.7	4.3	4.2	0.04	0.02	-0.95	-0.92	-0.98	0.51	1.49
15:15	10825	6.2	5.7	4.3	4.2	0.04	0.00	-0.95	-0.92	-0.98	0.53	1.52
15:30	10827	6.2	5.7	4.3	4.2	0.03	0.01	-0.95	-0.92	-0.98	0.51	1.49
15:45	10824	6.2	5.7	4.3	4.3	0.03	0.02	-0.95	-0.92	-0.98	0.49	1.47
15:49	9929	6.0	5.5	4.2	4.1	0.05	0.02	-0.94	-0.92	-0.98	0.49	1.47
15:52	9025	5.5	5.8	3.9	4.1	0.06	0.03	-0.94	-0.92	-0.98	0.48	1.46
15:54	8121	5.6	5.1	4.1	4.0	0.06	0.04	-0.94	-0.92	-0.98	0.45	1.43
15:57	7215	5.6	5.2	4.1	4.1	0.06	0.03	-0.94	-0.92	-0.98	0.44	1.43
16:07	0	------	------	------	------	0.00	-0.02	-0.94	-0.93	-0.98	0.45	1.43

INSPECTION TEAM
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LG E&C
Oct. 15, 2003

御立会者 WITNESSED BY 日付 DATE

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審査 TEST ENGINEER 日付 DATE

N. ISHIKAWA N. Ishikawa 03/10/15

記録 RECORDED BY 日付 DATE

T. NISHIYAMA T. Nishiyama 03/10/15

コンプレッサ運転記録

8

COMPRESSOR RUNNING TEST RECORD (2/3)

PAGE : 1

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

回転方向（駆動側から見て） DIRECTION OF ROTATION (facing drive end) : 時計 CW　　ロータ ROTOR : B 8　　起動 START 10:08　　停止 STOP 16:07

時刻 TIME	回転数 SPEED min⁻¹	軸受給油圧 LUBE OIL PRESS. kgf/cm²G	軸受給油温度 LUBE OIL INLET TEMP. ℃	軸受戻り油温度 駆動側 LUBE DRAIN TEMP. (DE) ℃	軸受戻り油温度 反駆動側 LUBE DRAIN TEMP. (OP.DE) ℃	軸受戻り油温度スラスト LUBE DRAIN TEMP. (THRUST) ℃							
9:35	0	1.18	43.6	41.8	43.0	43.5							
10:07	20	1.15	47.7	45.7	47.6	47.6							
10:16	1024	1.16	46.7	45.4	46.9	47.0							
10:36	2956	1.14	46.6	48.5	48.9	48.4							
10:49	7213	1.11	46.7	58.9	56.7	54.1							
10:59	10828	1.11	46.7	67.1	65.1	61.2							
11:03	11904	1.11	46.6	70.7	68.1	63.7							
11:09	7219	1.12	46.7	60.1	57.0	54.1							
11:14	8127	1.15	46.7	61.8	58.6	55.4							
11:16	9022	1.16	46.6	63.5	60.4	57.0							
11:18	9922	1.16	46.5	65.2	62.6	58.7							
11:21	10826	1.17	46.7	67.3	64.5	60.8							
11:27	11789	1.17	46.7	71.1	67.6	63.1							
11:42	11788	1.16	46.4	72.7	67.9	62.8							
11:45	10826	1.15	46.5	69.8	65.4	60.6							
12:00	10827	1.15	46.4	69.6	65.1	60.5							
12:15	10824	1.16	46.4	69.6	65.1	60.4							

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INSPECTION TEAM
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審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA　　03/10/15

記録 RECORDED BY　　日付 DATE

T.NISHIYAMA　　03/10/15

コンプレッサ運転記録

COMPRESSOR RUNNING TEST RECORD (2/3)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

回転方向（駆動側から見て） DIRECTION OF ROTATION (facing drive end) : 時計 CW　　ロータ ROTOR : B B　　起動 START 10:08　　停止 STOP 16:07

時刻 TIME	回転数 SPEED min⁻¹	軸受給油圧 LUBE OIL PRESS. kgf/cm²G	軸受給油温度 LUBE OIL INLET TEMP. ℃	軸受戻り油温度 駆動側 LUBE DRAIN TEMP. (DE) ℃	軸受戻り油温度 反駆動側 LUBE DRAIN TEMP. (OP.DE) ℃	軸受戻り油温度スラスト LUBE DRAIN TEMP. (THRUST) ℃							
12:30	10828	1.19	46.5	69.5	65.0	60.3							
12:45	10828	1.19	46.5	69.5	65.0	60.3							
13:00	10828	1.26	43.1	67.0	62.5	57.4							
13:06	10828	1.30	42.6	66.3	61.9	56.9							
13:15	10827	1.30	42.5	66.2	61.9	56.8							
13:21	10828	1.28	42.5	66.1	61.8	56.8							
13:30	10825	1.19	45.7	68.6	64.1	59.5							
13:43	10826	1.04	49.1	72.0	67.5	62.7							
13:45	10825	1.03	49.5	72.4	67.8	63.0							
13:58	10826	1.04	49.9	73.0	68.3	63.4							
14:00	10827	1.03	49.9	73.0	68.4	63.4							
14:15	10828	1.17	46.2	69.8	65.1	60.1							
14:30	10828	1.17	46.0	69.4	64.9	60.0							
14:45	10827	1.16	46.1	69.5	65.0	60.0							
15:00	10827	1.17	46.2	69.7	65.1	60.1							
15:15	10825	1.17	46.2	69.7	65.0	60.1							
15:30	10827	1.17	46.1	69.8	65.1	60.1							
15:45	10824	1.15	46.2	69.8	65.1	60.1							
15:49	9929	1.16	46.1	67.4	63.2	58.4							
15:52	9025	1.17	46.1	65.0	60.9	56.7							
15:54	8121	1.17	46.1	63.2	59.2	55.1							
15:57	7215	1.18	46.2	60.7	56.7	53.6							
16:07	0	1.22	46.0	46.9	46.6	46.2							

LG E&C INSPECTION TEAM ☑WITNESSED ☐REVIEWED oct. 15, 2003

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N.ISHIKAWA　　03/10/15

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T.NISHIYAMA　　03/10/15

コンプレッサ運転記録

10

COMPRESSOR RUNNING TEST RECORD (3/3)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

回転方向（駆動側から見て） DIRECTION OF ROTATION (facing drive end) : 時計 CW　　ロータ ROTOR : B B　　起動 START 10:08　　停止 STOP 16:07

時刻 TIME	回転数 SPEED min^{-1}	ジャーナル軸受温度 駆動側 JNL.BRG TEMP. (DE) ℃	ジャーナル軸受温度 駆動側 JNL.BRG TEMP. (DE) ℃	ジャーナル軸受温度 反駆動側 JNL.BRG TEMP. (OP DE) ℃	ジャーナル軸受温度 反駆動側 JNL.BRG TEMP. (OP DE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 反負荷側 THRUST. BRG TEMP. (INACTIVE) ℃	スラスト軸受温度 反負荷側 THRUST. BRG TEMP. (INACTIVE) ℃			
9:35	0	39.7	39.8	42.2	42.3	43.6	43.7	43.7	43.4	43.5			
10:07	20	44.9	45.0	47.1	47.3	48.2	48.1	48.1	47.9	48.0			
10:16	1024	48.8	48.9	50.3	50.6	49.2	47.7	48.8	50.3	50.7			
10:36	2956	59.9	58.2	60.5	58.7	49.1	48.9	48.8	53.0	54.2			
10:49	7213	80.5	75.1	77.5	73.7	52.4	53.7	51.7	54.9	55.8			
10:59	10828	94.5	87.2	87.9	85.3	57.6	58.8	56.0	63.6	61.0			
11:03	11904	98.4	90.1	89.9	88.6	59.7	61.5	57.6	66.3	63.7			
11:09	7219	80.9	74.5	77.4	73.9	53.0	54.3	52.3	54.2	54.8			
11:14	8127	84.1	77.1	80.2	76.3	53.8	55.0	52.8	55.0	55.5			
11:16	9022	88.1	81.0	83.4	79.4	55.0	55.9	53.7	56.4	56.6			
11:18	9922	91.8	84.2	86.5	82.9	56.1	56.9	54.6	59.0	57.9			
11:21	10826	94.4	86.9	88.3	85.1	57.4	58.5	55.8	62.1	60.0			
11:27	11789	97.3	88.9	89.6	88.1	59.4	61.1	57.5	65.0	62.8			
11:42	11788	97.0	87.9	89.3	87.8	59.3	61.1	57.3	63.8	62.2			
11:45	10826	93.9	85.0	87.6	84.7	57.6	58.9	55.8	60.8	59.4			
12:00	10827	94.0	85.5	87.9	84.6	57.5	59.0	55.8	60.3	59.2			
12:15	10824	94.0	85.3	87.9	84.7	57.6	59.0	55.7	60.1	59.0			

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INSPECTION TEAM
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Oct. 15, 2003

御立会者 WITNESSED BY　　日付 DATE

/ /

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N.ISHIKAWA　　03/10/15

記録 RECORDED BY　　日付 DATE

T.NISHIYAMA　　03/10/15

コンプレッサ運転記録

COMPRESSOR RUNNING TEST RECORD (3/3)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

回転方向（駆動側から見て） DIRECTION OF ROTATION (facing drive end) : 時計 CW	ロータ ROTOR : B B	起動 START 10:08	停止 STOP 16:07

時刻 TIME	回転数 SPEED min^{-1}	ジャーナル軸受温度 駆動側 JNL.BRG TEMP. (DE) ℃	ジャーナル軸受温度 駆動側 JNL.BRG TEMP. (DE) ℃	ジャーナル軸受温度 反駆動側 JNL.BRG TEMP. (OP DE) ℃	ジャーナル軸受温度 反駆動側 JNL.BRG TEMP. (OP DE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 反負荷側 THRUST. BRG TEMP. (INACTIVE) ℃	スラスト軸受温度 反負荷側 THRUST. BRG TEMP. (INACTIVE) ℃			
12:30	10828	93.9	85.2	87.9	84.4	57.5	59.0	55.6	59.7	58.9			
12:45	10828	93.9	85.3	87.9	84.5	57.4	58.9	55.5	59.6	59.0			
13:00	10828	93.7	83.7	87.6	83.7	54.6	56.0	52.6	56.2	55.2			
13:06	10828	94.0	84.0	87.7	83.7	54.1	55.6	52.1	55.6	54.7			
13:15	10827	94.1	84.0	87.6	83.6	53.9	55.5	52.1	55.5	54.4			
13:21	10828	94.0	84.0	87.7	83.6	53.9	55.4	52.0	55.3	54.4			
13:30	10825	94.0	85.3	88.2	84.5	56.5	57.9	54.7	58.6	58.2			
13:43	10826	94.0	86.2	88.7	86.2	59.7	61.4	58.0	62.3	62.3			
13:45	10825	94.0	86.3	88.7	86.3	60.1	61.8	58.5	62.6	62.7			
13:58	10826	94.0	86.2	88.8	86.3	60.4	62.0	58.7	62.8	63.1			
14:00	10827	94.0	86.2	88.7	86.3	60.4	62.1	58.7	62.9	63.1			
14:15	10828	93.8	85.0	87.8	84.1	57.2	58.7	55.3	58.9	58.8			
14:30	10828	93.6	85.0	87.8	84.1	57.1	58.6	55.1	58.9	58.8			
14:45	10827	93.6	85.0	87.9	84.1	57.0	58.5	55.2	58.9	58.7			
15:00	10827	93.7	85.0	87.8	84.1	57.0	58.6	55.2	59.0	58.7			
15:15	10825	93.7	84.9	87.8	84.0	57.1	58.6	55.2	59.0	58.8			
15:30	10827	93.6	84.9	87.8	84.0	57.0	58.5	55.1	59.0	58.7			
15:45	10824	93.6	85.0	88.0	84.0	57.1	58.5	55.2	59.0	58.9			
15:49	9929	90.8	82.1	85.8	81.9	56.0	57.3	54.3	57.1	56.4			
15:52	9025	87.8	79.7	83.1	79.2	55.1	56.5	53.7	55.1	54.9			
15:54	8121	84.3	76.8	80.5	76.8	53.8	55.6	53.0	53.6	54.0			
15:57	7215	80.5	74.1	77.3	73.6	53.0	54.3	52.5	52.6	53.3			
16:07	0	51.2	51.2	49.4	50.2	47.0	46.9	46.7	46.7	46.7			

LG E&C

INSPECTION TEAM
☑WITNESSED ☐REVIEWED
Oct. 15, 2003

御立会者 WITNESSED BY 日付 DATE

/ /

審査 TEST ENGINEER 日付 DATE

N.ISHIKAWA N. Ishikawa 03/10/15

記録 RECORDED BY 日付 DATE

T.NISHIYAMA T. Nishiyama 03/10/15

2 Record for Compressor

2-2 Vibration Amplitude Record

a Bode Plot of Start up

[Note]

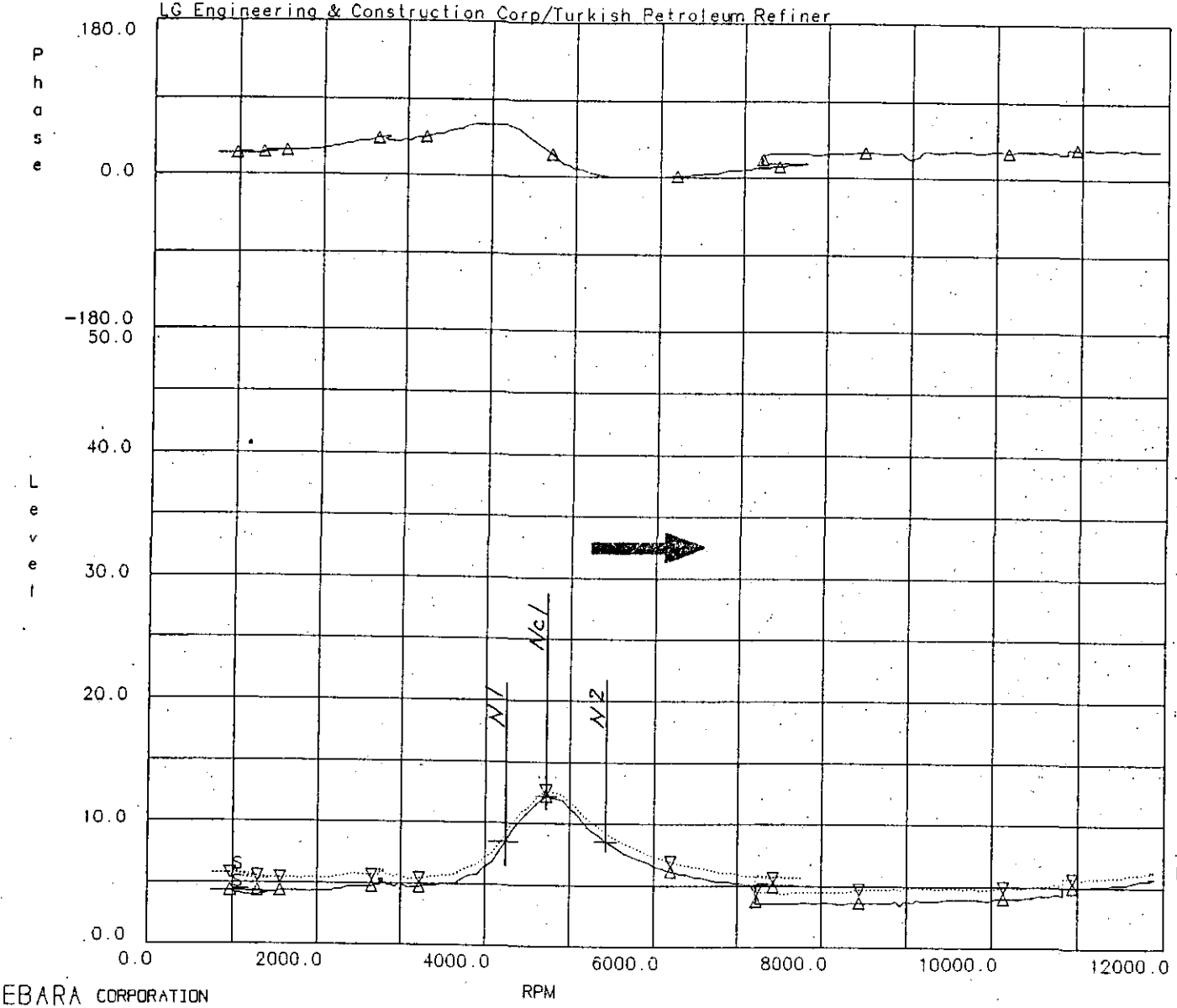
C.CP.X	:	Drive End X
C.CP.Y	:	Drive End Y
C.OCP.X	:	Non Drive End X
C.OCP.Y	:	Non Drive End Y

EO : 1.0	:	Synchronous Frequency
TOTAL	:	Overall
Unit	:	Vibration : μm p-p
		Phase : Degree

LG E&C
INSPECTION TEAM
☑WITNESSED ☐REVIEWED
Oct. 15, 2003

R0215708
25MB5

SRV-5DF
LG Engineering & Construction Corp/Turkish Petroleum Refiner



△ C.CP.X EO: 1.0
▽ C.CP.X TOTAL

AF = Nc.1 / (N2-N1)
= 4721 / (5428 - 4228)
= **3.93**

SM ≧ 100 - (84 + 6 / (AF - 3))
≧ 100 - (84 + 6 / (3.93 - 3))
≧ **9.6 %**

SM test = (Nmin - Nc.1) / Nmin
=(7218 - 4721) / 7218
= **34.6 %**

(Min.Speed = 7218 rpm)

PK to PK

LG E&C
INSPECTION TEAM
☑WITNESSED ☐REVIEWED
Oct. 15, 2003

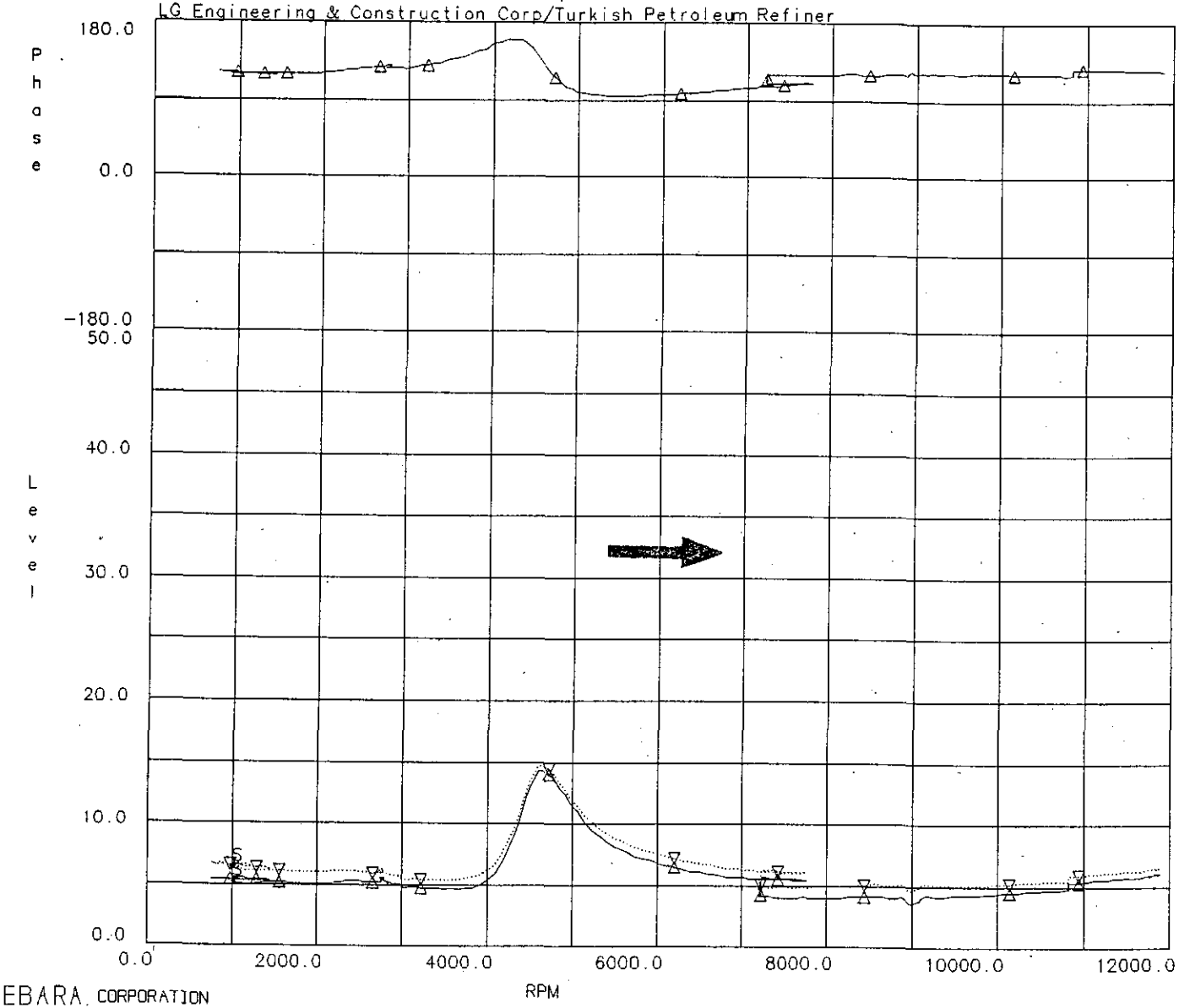
EBARA CORPORATION

Wed Oct 15 10:06:29 2003

R0215708
25MB5

SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
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LG E&C
Oct-15,2003

EBARA CORPORATION

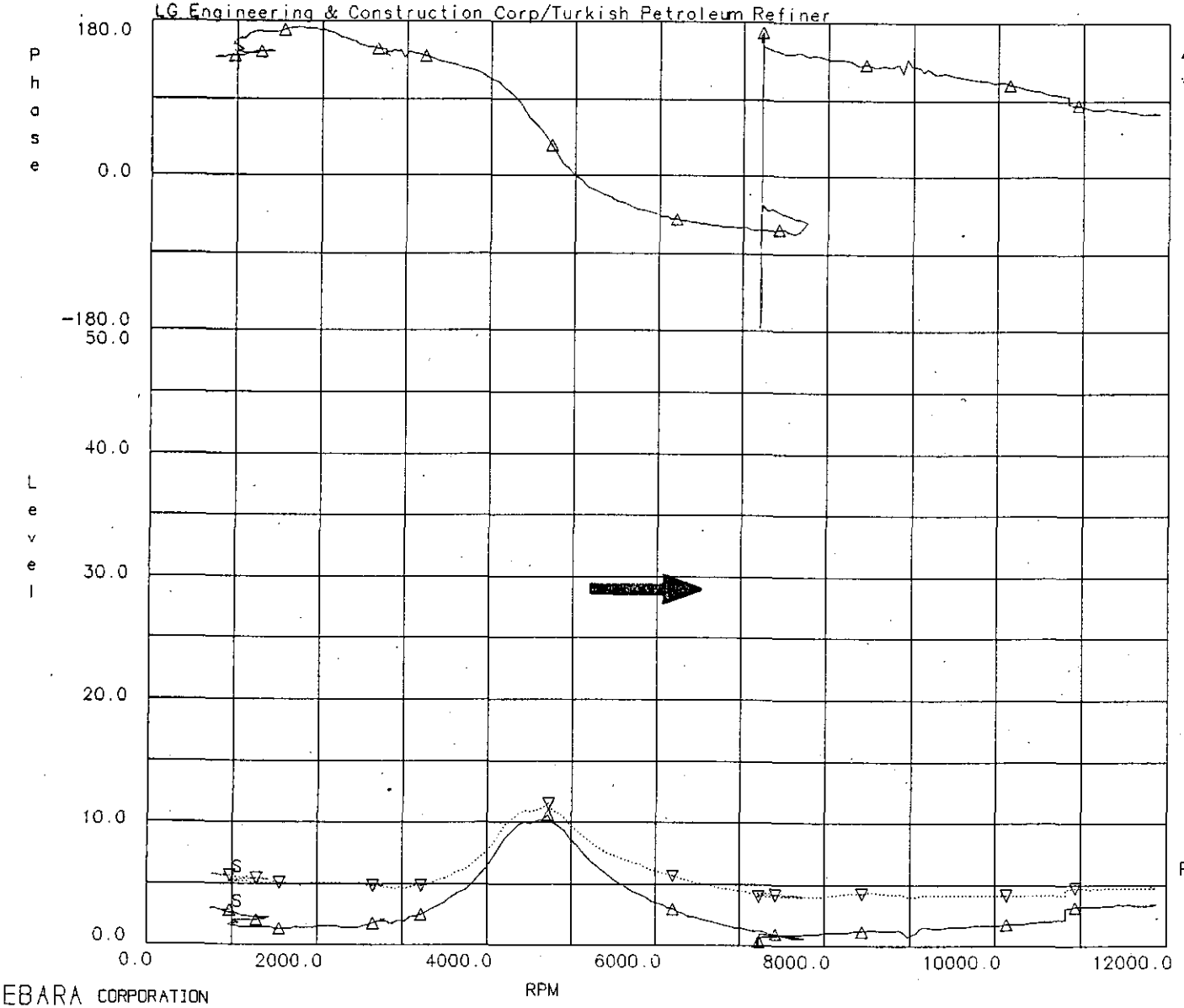
Wed Oct 15 10:06:29 2003

14

R0215708
25MB5

SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
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LG E&C
Oct. 15, 2003

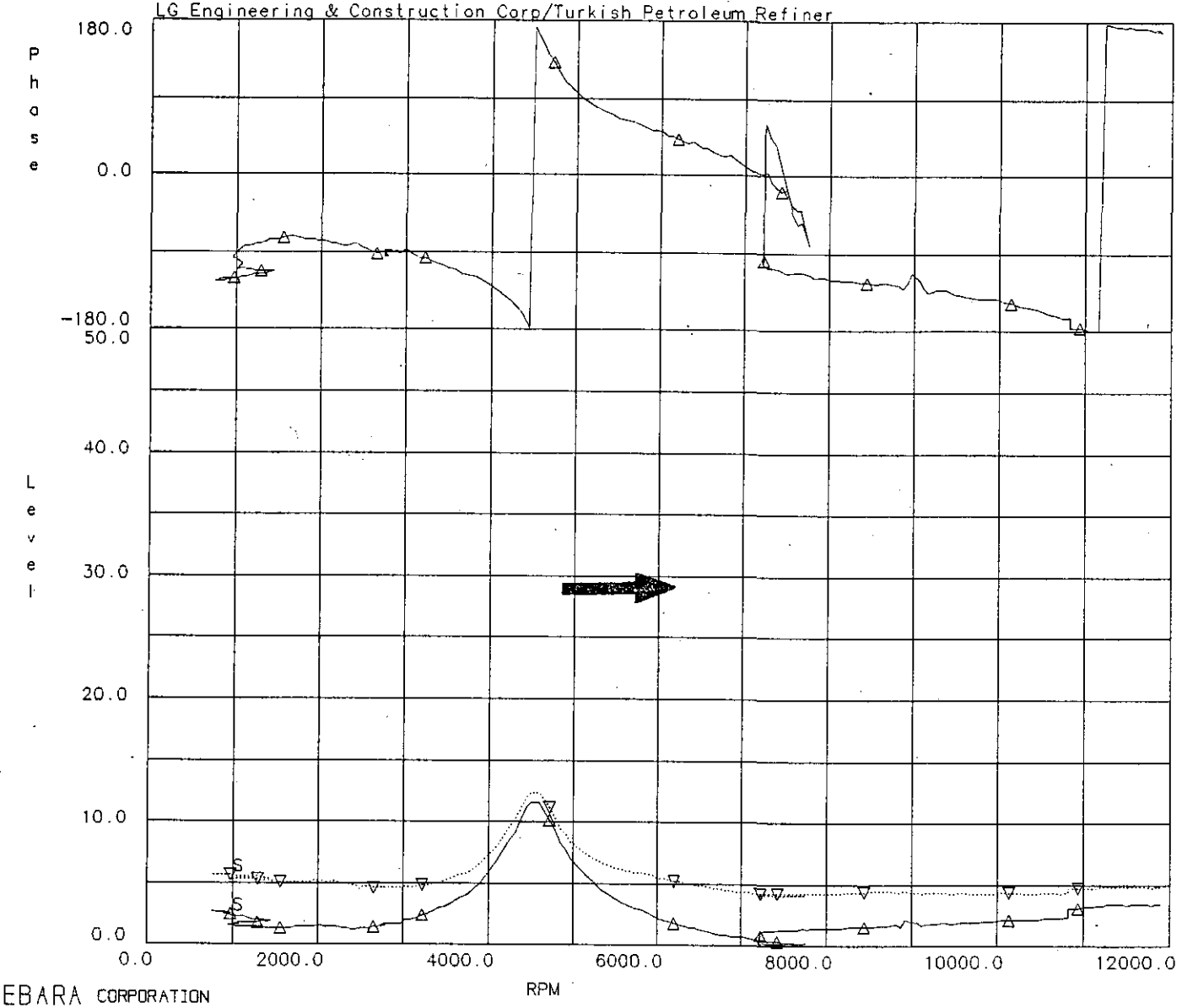
EBARA CORPORATION

Wed Oct 15 10:06:29 2003

R0215708
25MB5

SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
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Oct. 15, 2003
LG E&C

EBARA CORPORATION

Wed Oct 15 10:06:29 2003

2 Record for Compressor

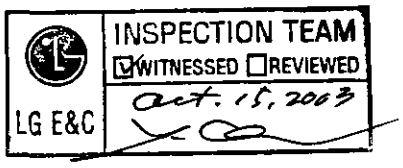
2-2 Vibration Amplitude Record

b Bode Plot of Coast Down

[Note]

C.CP.X	:	Drive End X
C.CP.Y	:	Drive End Y
C.OCP.X	:	Non Drive End X
C.OCP.Y	:	Non Drive End Y

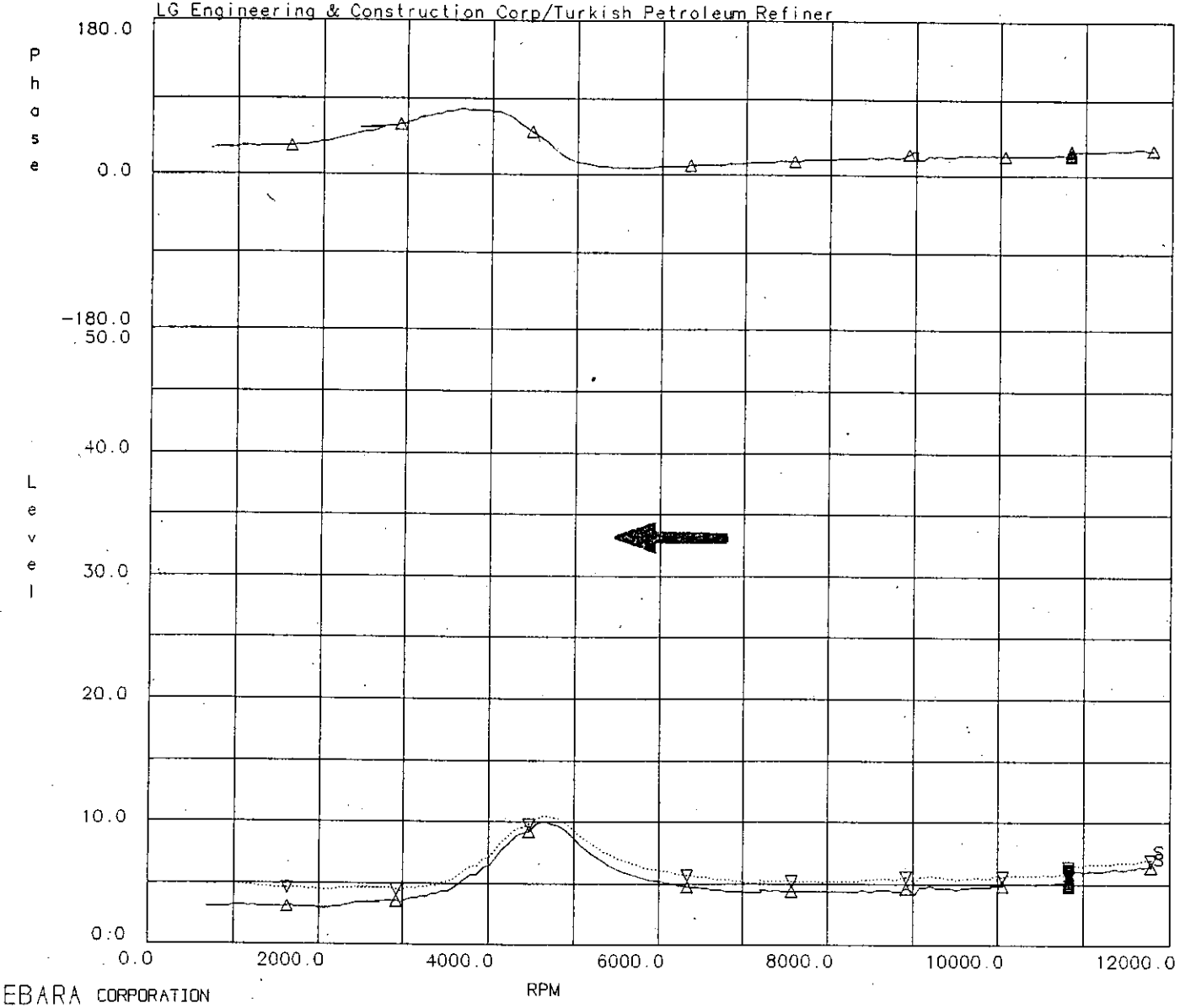
EO : 1.0	:	Synchronous Frequency
TOTAL	:	Overall
Unit	.	Vibration : μm p-p
.	.	Phase : Degree
. .	.	.



R0215708
25MB5

SRV--5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



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Oct. 15, 2003

EBARA CORPORATION

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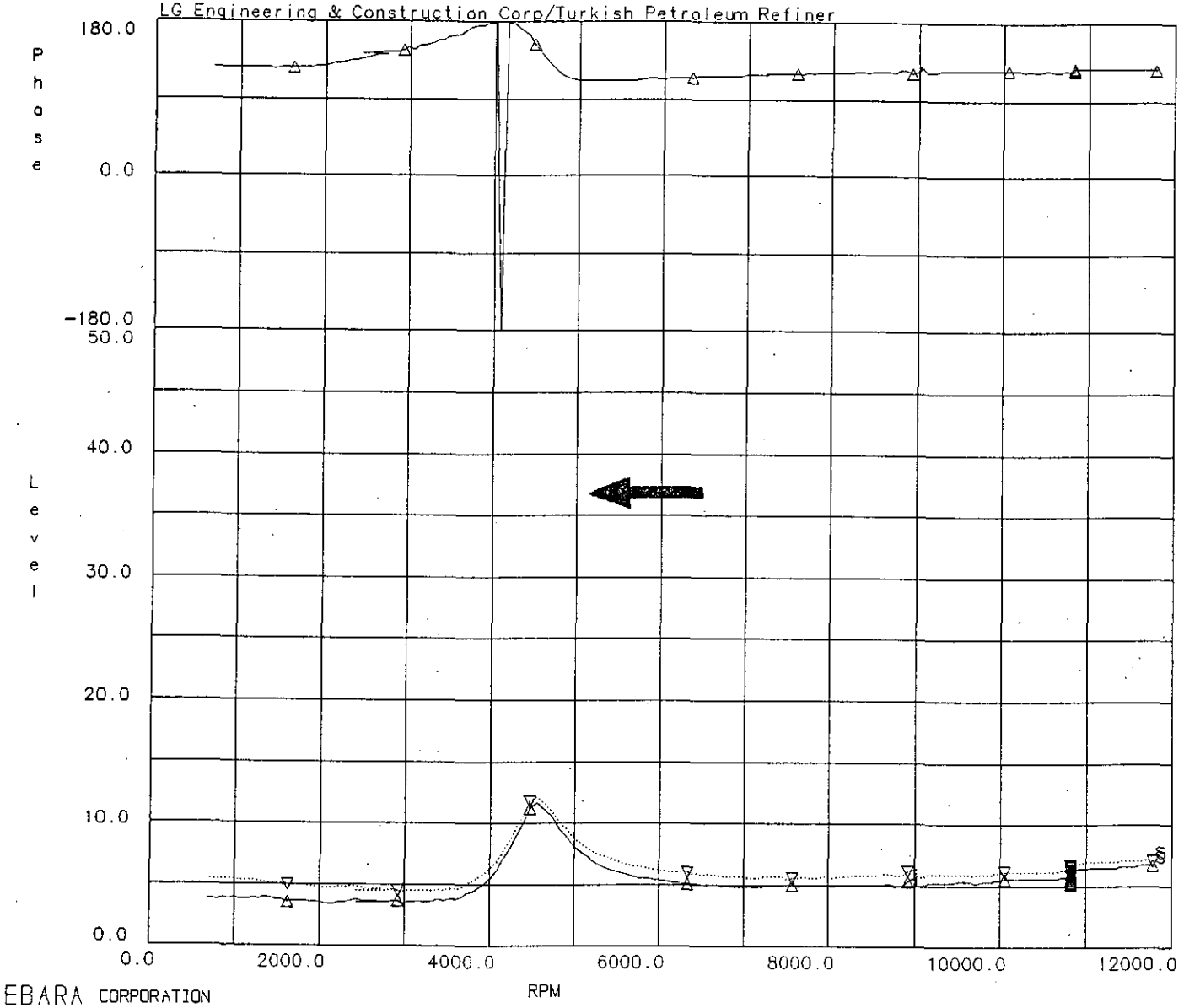
SRV-5DF
LG Engineering & Construction Corp/Turkish Petroleum Refiner



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LG E&C
Oct. 15, 2003

EBARA CORPORATION

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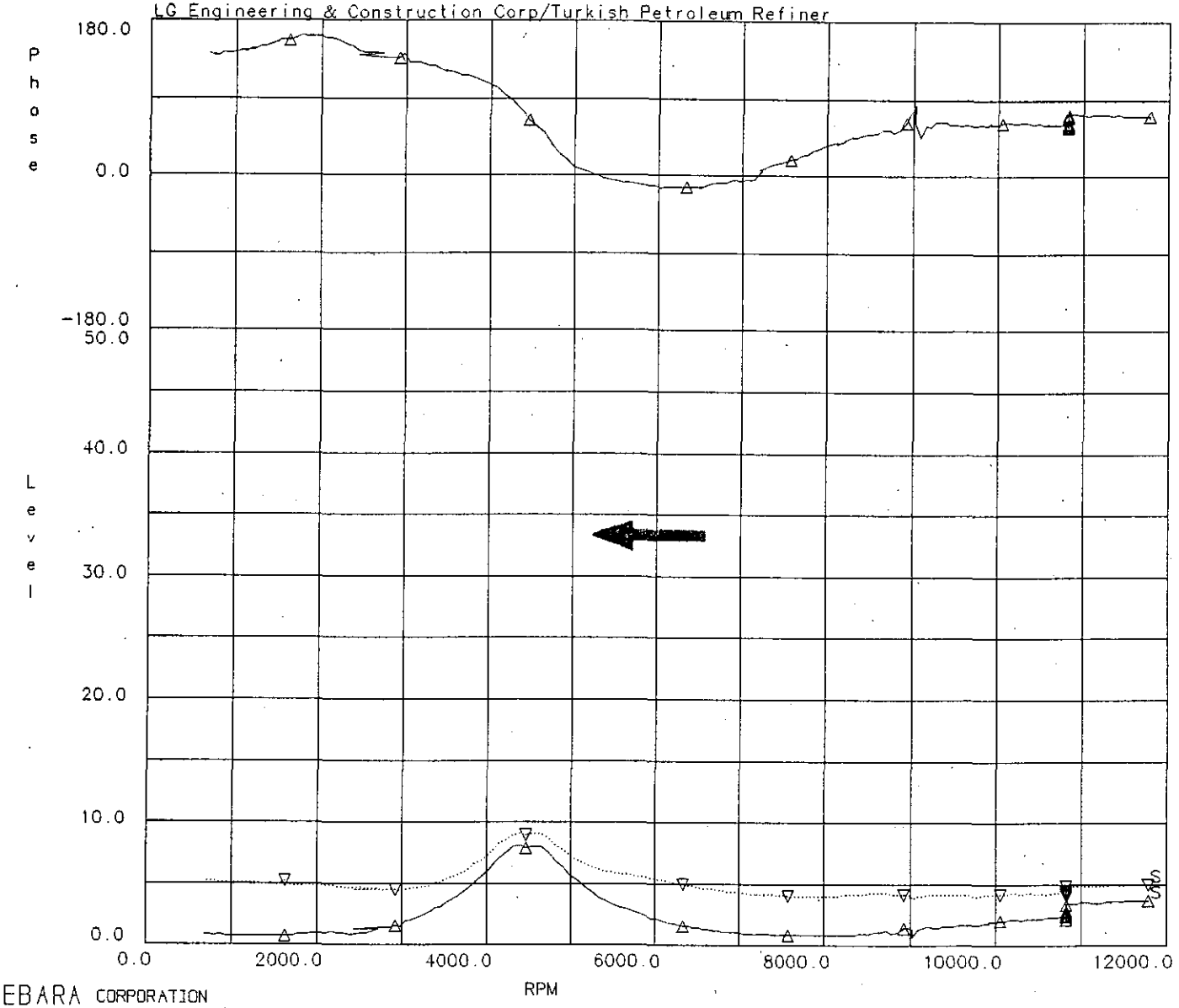
GT-19

R0215708
25MB5

SRV-5DF
LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
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Oct. 15, 2003
LG E&C

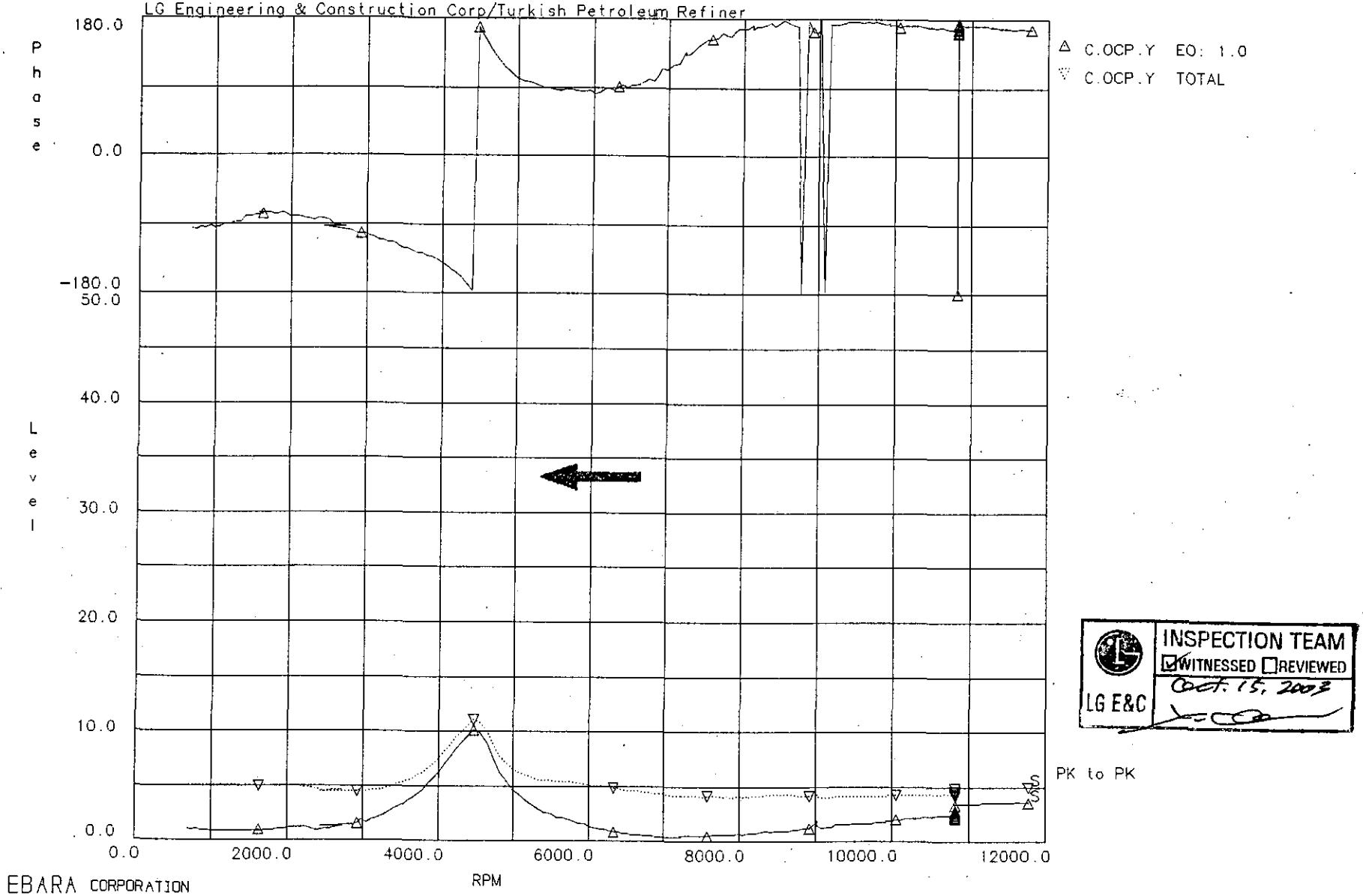
EBARA CORPORATION

Wed Oct 15 10:06:29 2003

R0215708
25MB5

SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
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Oct. 15, 2003
LG E&C

EBARA CORPORATION

Wed Oct 15 10:06:29 2003

2 Record for Compressor

2-3 Vibration Sweep Record

at MCS

(Note)

C.CP.X	:	Drive End X
C.CP.Y	:	Drive End Y
C.OCP.X	:	Non Drive End X
C.OCP.Y	:	Non Drive End Y

Unit : μm p-p

INSPECTION TEAM
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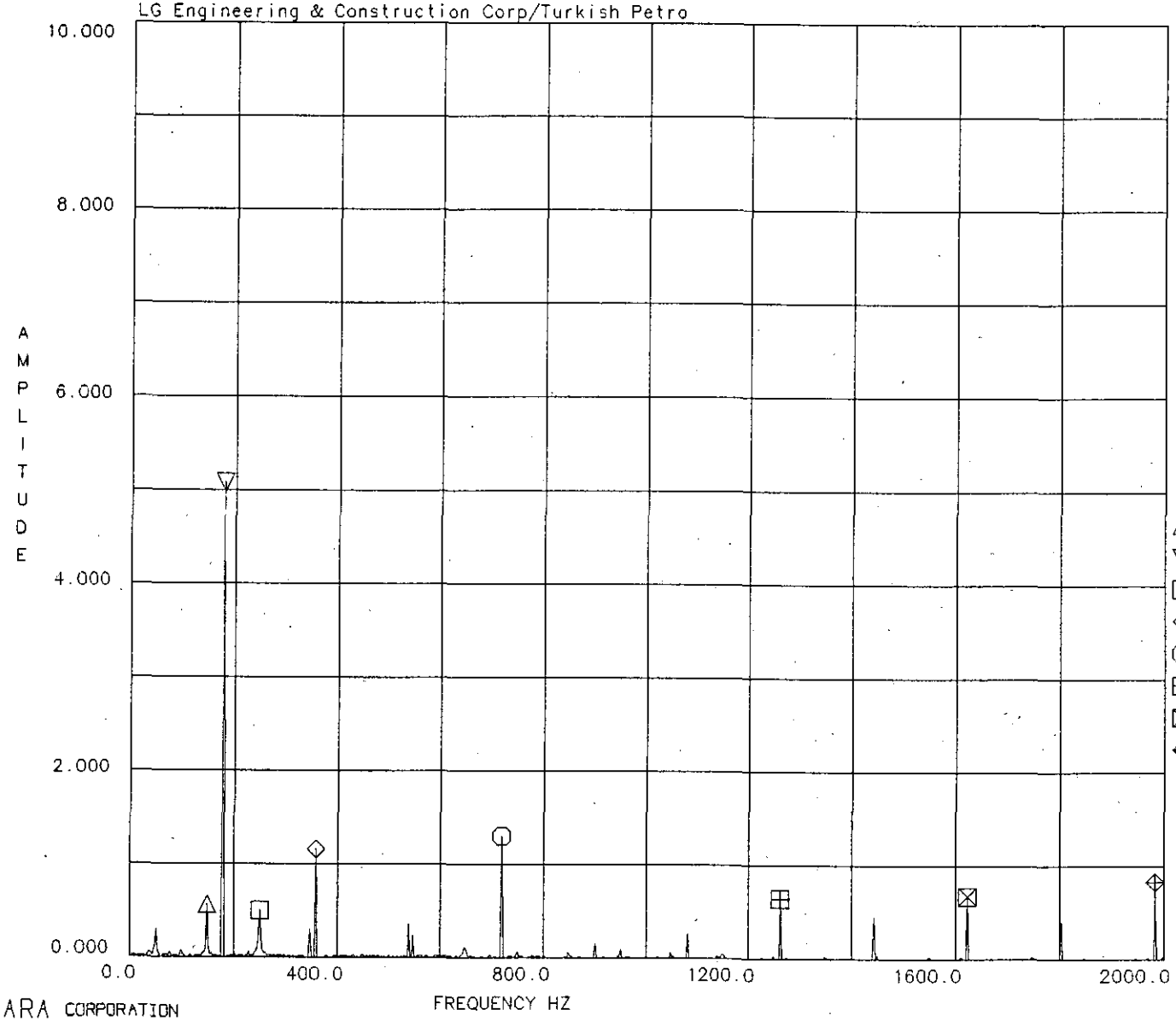
LG E&C Oct. 15, 2003

R0215708
25MB5

SRV-5DF
LG Engineering & Construction Corp/Turkish Petro



C.CP.X

P-P

N1 rpm10827
TIME 14:44:27

	FREQ	AMP
△	149	0.572
▽	180	5.083
□	251	0.506
◇	361	1.168
○	722	1.304
⊞	1263	0.648
⊠	1624	0.683
⊕	1985	0.831

Overall 5.71

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INSPECTION TEAM
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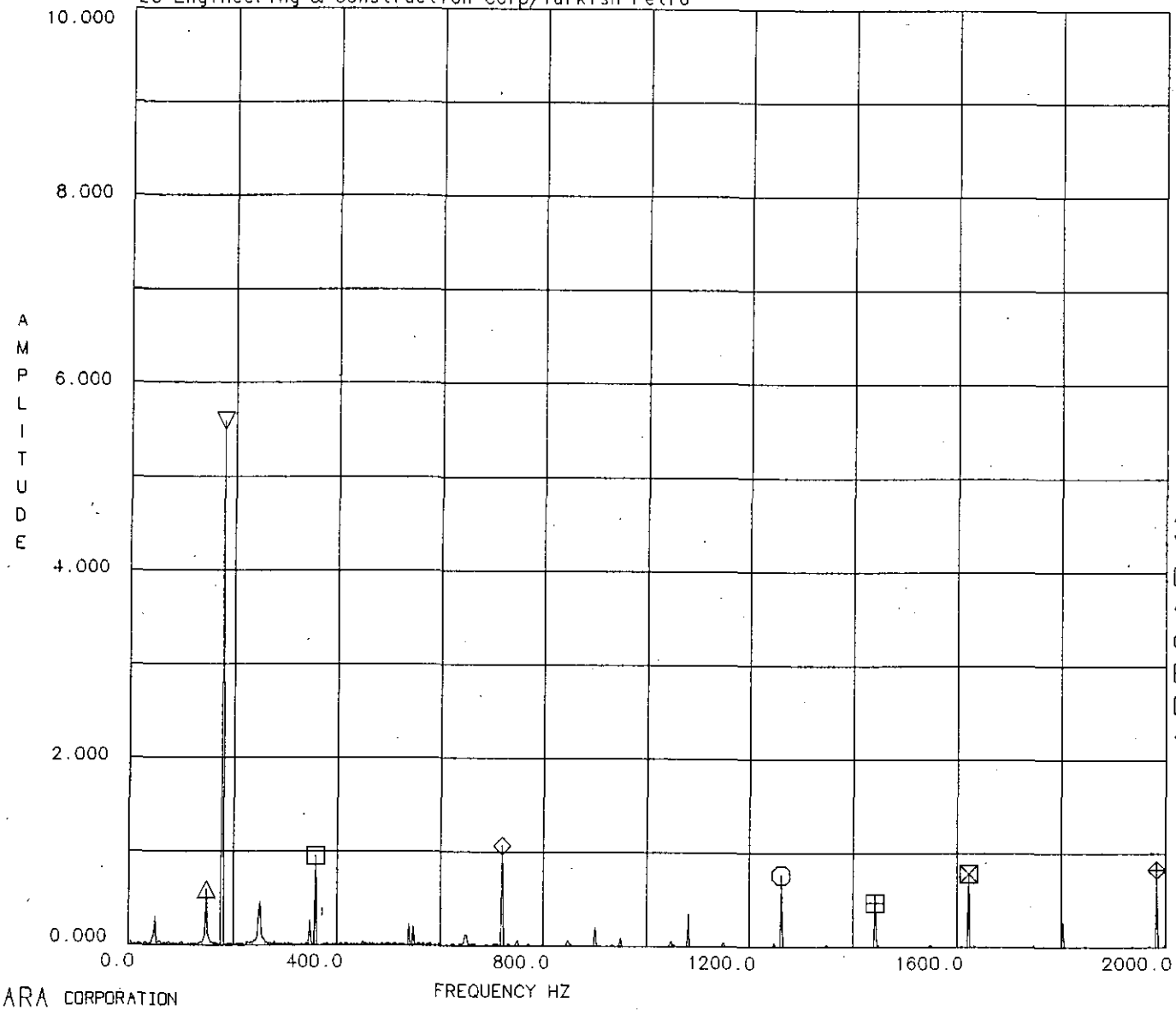
Wed Oct 15 10:06:29 2003

R0215708
25MB5

SRV-5DF
LG Engineering & Construction Corp/Turkish Petro



C.CP.Y

P-P

N1 rpm10827
TIME 14:44:27

	FREQ	AMP
△	149	0.600
▽	180	5.603
□	361	0.954
◇	722	1.072
○	1263	0.778
⊞	1444	0.482
⊠	1624	0.782
⊕	1985	0.837

Overall 6.13

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EBARA CORPORATION

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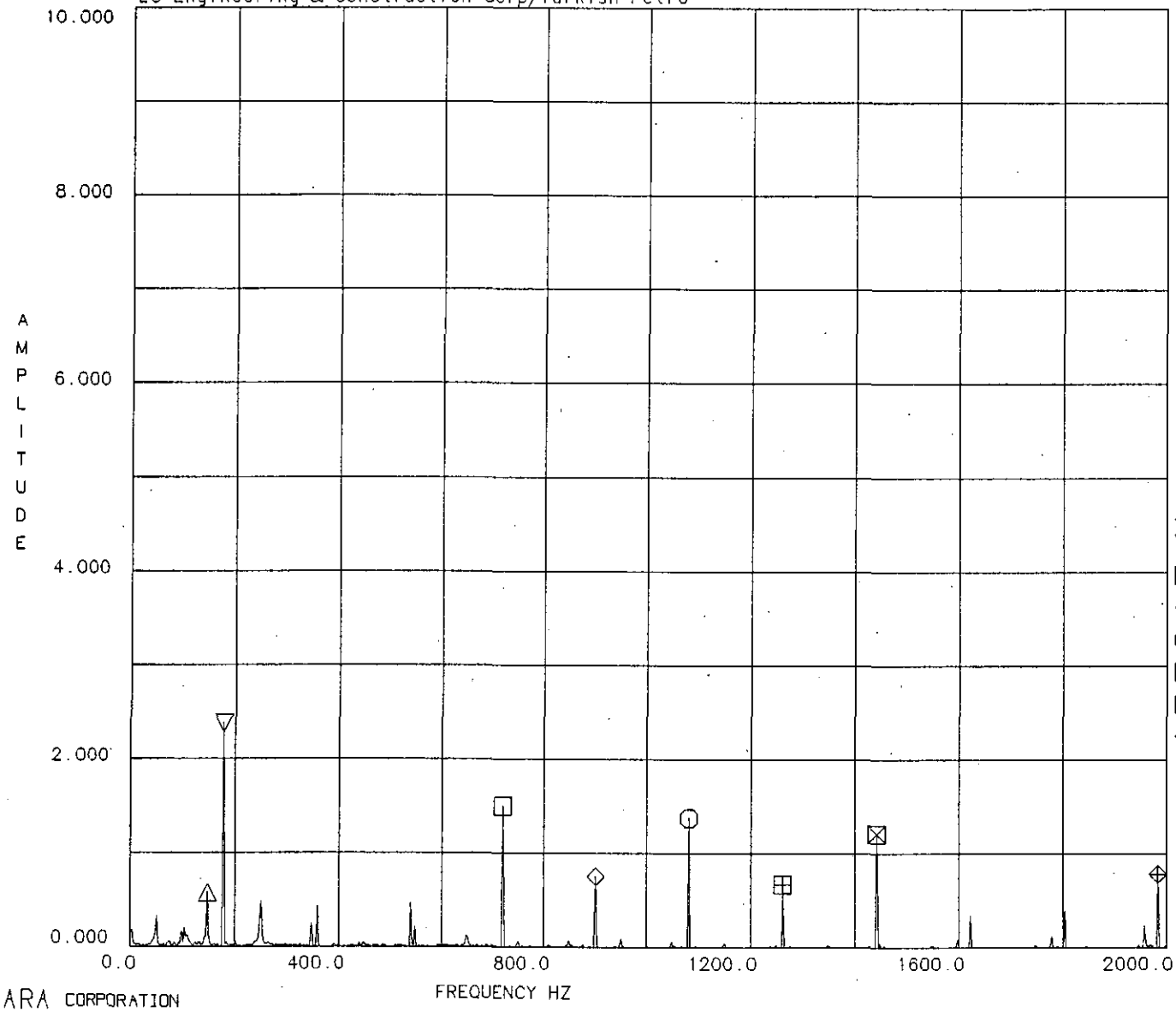
R0215708
25MB5

SRV-5DF
LG Engineering & Construction Corp/Turkish Petro



C.OCP.X

P-P

N1 rpm10827
TIME 14:44:27

	FREQ	AMP
△	149	0.590
▽	180	2.387
□	722	1.509
◇	902	0.764
○	1083	1.382
⊞	1263	0.686
⊠	1444	1.207
⊕	1985	0.796

Overall 4.10

EBARA CORPORATION

I.G E&C
INSPECTION TEAM
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Wed Oct 15 10:06:29 2003

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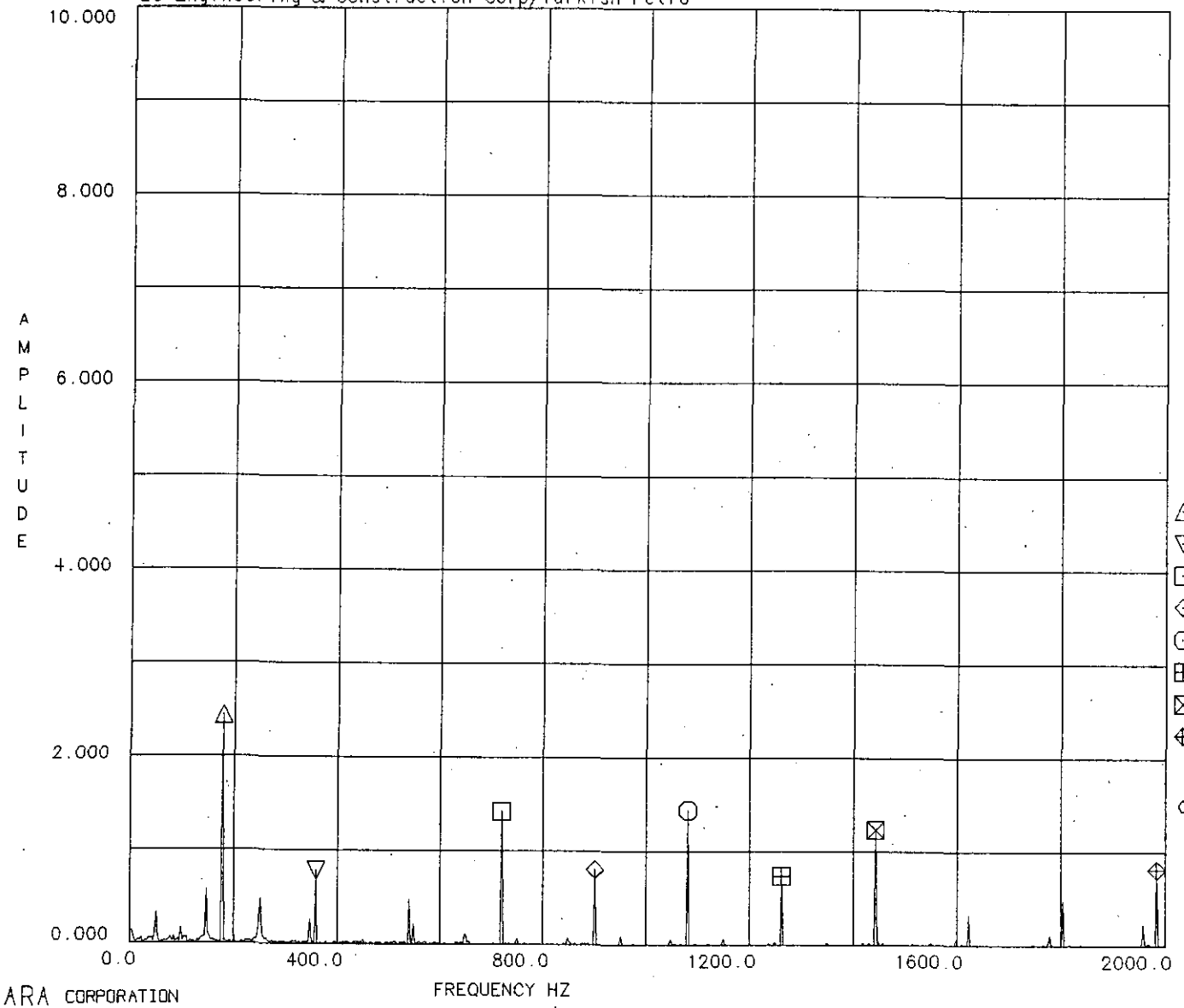
SRV-5DF
LG Engineering & Construction Corp/Turkish Petro



C.OCP.Y

P-P

N1 rpm10827
TIME 14:44:27

	FREQ	AMP
△	180	2.442
▽	361	0.786
□	722	1.429
◇	902	0.805
○	1083	1.441
⊞	1263	0.735
⊠	1444	1.247
⊕	1985	0.819

Overall 4.20

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Oct. 15, 2003

EBARA CORPORATION

Wed Oct 15 10:06:29 2003

3 Record for Turbine

3-1 Running Test Record

Period		
10:08	to 16:07	Normal Mechanical Running Test
11:27	to 11:42	Over Speed Running
11:45	to 15:45	4hours Running at MCS
		*Bearing Performance Test
13:06	to 13:21	Lube Oil Supply Temp. = 43 ℃
		Lube Oil Supply Press. = 1.27kg/cm2G
13:43	to 13:58	Lube Oil Supply Temp. = 49 ℃
		Lube Oil Supply Press. = 1.05kg/cm2G

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INSPECTION TEAM
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Oct. 15, 2003

蒸気タービン運転記録

28

STEAM TURBINE RUNNING TEST RECORD (1/3)

PAGE : 1

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	TC-9901	R0215708	SRV-5DF

回転方向（蒸気入口側から見て） DIRECTION OF ROTATION (facing STEAM end) : 時計 CW

ロータ ROTOR : B B

起動 START 10:08 停止 STOP 16:07

時刻 TIME	回転数 SPEED min⁻¹	軸振動 SHAFT VIBRATION (μm p-p) カップリング側 CP END CH. NO 14	CH. NO 13	反カップリング側 OCP END CH. NO 12	CH. NO 11	軸移動量1 AXIAL DISP.1 mm	軸移動量2 AXIAL DISP.2 mm	主蒸気圧 INLET STEAM PRESS. kgf/cm²G	排気圧 EXHAUST STEAM PRESS. kgf/cm²G	シール蒸気圧 主蒸気側 SEAL STEAM INLET SIDE kgf/cm²G	グランドリーク圧 GRAND LEAK PRESS. kgf/cm²G		
9:35	0	------	------	------	------	-0.07	-0.07	0.1	-0.58	-0.36	-0.15		
10:07	20	------	------	------	------	-0.07	-0.07	29.9	-0.87	-0.62	-0.43		
10:16	1024	4.7	5.5	2.5	2.6	-0.02	-0.02	32.4	-0.88	0.26	-0.15		
10:36	2956	3.3	3.9	2.1	2.2	0.01	0.00	37.3	-0.89	0.22	-0.14		
10:49	7213	2.9	3.1	2.5	1.9	0.00	-0.00	31.0	-0.89	0.22	-0.16		
10:59	10828	4.9	5.2	11.0	7.4	-0.02	-0.03	29.3	-0.89	0.23	-0.16		
11:03	11904	3.8	7.8	15.9	11.8	-0.02	-0.03	27.5	-0.89	0.23	-0.16		
11:09	7219	3.0	2.9	2.6	2.1	0.00	-0.01	33.8	-0.88	0.22	-0.18		
11:14	8127	3.2	2.8	3.0	2.2	-0.01	-0.02	33.0	-0.88	0.22	-0.18		
11:16	9022	4.4	3.3	4.1	3.0	-0.01	-0.02	34.0	-0.89	0.22	-0.18		
11:18	9922	4.9	3.5	6.9	5.0	-0.01	-0.02	30.7	-0.88	0.23	-0.18		
11:21	10826	4.6	5.0	8.8	6.2	-0.01	-0.04	29.9	-0.89	0.23	-0.19		
11:27	11789	3.3	6.6	13.4	9.7	-0.02	-0.05	26.3	-0.88	0.22	-0.19		
11:42	11788	3.2	6.5	13.5	9.9	-0.03	-0.04	26.9	-0.88	0.22	-0.19		
11:45	10826	4.5	5.1	8.6	5.7	-0.02	-0.04	29.0	-0.88	0.23	-0.19		
12:00	10827	5.2	5.7	7.7	5.4	-0.02	-0.03	30.7	-0.88	0.23	-0.19		
12:15	10824	5.1	5.5	7.7	5.2	-0.01	-0.04	32.9	-0.88	0.23	-0.18		

一次危険速度 FIRST CRITICAL SPEED	3997 min⁻¹
蒸気気密性 STEAM TIGHTNESS	合格 ACCEPTABLE
外部油漏れ OUTWARD OIL LEAKAGE	合格 NO LEAK
手動トリップテスト HAND TRIP TEST	合格 ACCEPTABLE
遠隔トリップテスト REMOTE TRIP TEST	合格 ACCEPTABLE

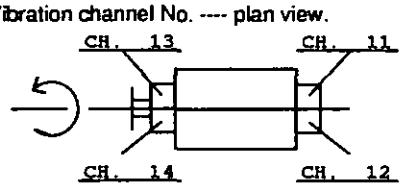
調速機試験 GOVERNOR TEST
速度範囲 SPEED RANGE 7218 ～ 10828 min⁻¹
試験結果 合格 ACCEPTABLE

テスト TRIAL NO.	1	2	3
過速度トリップテスト OVERSPEED TRIP TEST (min⁻¹)	11910		

規定値 11911 min⁻¹ ± 1% (11792 ～ 12030 min⁻¹)

[記事 NOTES]

1. 油 OIL : ISO VG#32
2. タービン軸中心と油圧力計との高さの差
   Differential head between the turbine centerline and the oil pressure gauge = 0.00 m, 0.00 kgf/cm²G
3. 軸振動計器番号 上から見て
   Vibration channel No. ---- plan view.



LG E&C INSPECTION TEAM ☑WITNESSED ☐REVIEWED Oct. 15, 2003

御立会者 WITNESSED BY 日付 DATE

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審査 TEST ENGINEER 日付 DATE

N.ISHIKAWA 03/10/15

記録 RECORDED BY 日付 DATE

T.NISHIYAMA 03/10/15

蒸気タービン運転記録

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STEAM TURBINE RUNNING TEST RECORD (1/3)

PAGE : 2

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	TC-9901	R0215708	SRV-5DF

回転方向（蒸気入口側から見て） DIRECTION OF ROTATION (facing STEAM end) : 時計 CW　　ロータ ROTOR : B　　起動 START 10:08　　停止 STOP 16:07

時刻 TIME	回転数 SPEED min⁻¹	軸振動 SHAFT VIBRATION (μm p-p) カップリング側 CP END CH. NO 14	カップリング側 CP END CH. NO 13	反カップリング側 OCP END CH. NO 12	反カップリング側 OCP END CH. NO 11	軸移動量1 AXIAL DISP.1 mm	軸移動量2 AXIAL DISP.2 mm	主蒸気圧 INLET STEAM PRESS. kgf/cm²G	排気圧 EXHAUST STEAM PRESS. kgf/cm²G	シール蒸気圧 主蒸気側 SEAL STEAM INLET SIDE kgf/cm²G	グランドリーク圧 GRAND LEAK PRESS. kgf/cm²G		
12:30	10828	4.9	5.1	7.2	4.4	-0.01	-0.03	32.7	-0.88	0.24	-0.18		
12:45	10828	5.4	5.0	6.9	3.5	-0.03	-0.04	31.5	-0.88	0.24	-0.18		
13:00	10828	5.5	4.3	6.3	2.8	-0.02	-0.04	33.2	-0.88	0.25	-0.18		
13:06	10828	5.7	4.3	6.3	2.9	-0.02	-0.04	31.5	-0.88	0.24	-0.18		
13:15	10827	6.0	4.3	6.4	3.1	-0.03	-0.04	31.8	-0.88	0.25	-0.18		
13:21	10828	6.0	4.3	6.2	3.2	-0.03	-0.04	32.8	-0.88	0.25	-0.18		
13:30	10825	6.0	4.7	7.4	4.3	-0.01	-0.03	32.0	-0.88	0.24	-0.18		
13:43	10826	5.1	4.9	9.8	6.4	-0.02	-0.04	31.7	-0.88	0.25	-0.18		
13:45	10825	5.1	4.9	9.8	6.5	-0.02	-0.03	33.9	-0.88	0.25	-0.18		
13:58	10826	4.3	4.5	9.2	6.0	-0.01	-0.03	33.6	-0.88	0.25	-0.18		
14:00	10827	4.0	4.4	9.2	5.9	-0.02	-0.04	32.7	-0.87	0.25	-0.18		
14:15	10828	4.2	3.9	6.6	3.4	-0.03	-0.04	32.3	-0.87	0.25	-0.18		
14:30	10828	4.1	3.9	7.0	3.5	-0.02	-0.04	33.7	-0.87	0.25	-0.18		
14:45	10827	4.5	4.3	7.9	4.1	-0.01	-0.04	31.9	-0.87	0.25	-0.18		
15:00	10827	4.7	4.6	8.9	5.1	-0.01	-0.03	32.0	-0.87	0.25	-0.18		
15:15	10825	4.7	4.6	9.1	5.4	-0.01	-0.03	33.1	-0.87	0.25	-0.18		
15:30	10827	4.5	4.2	8.3	4.9	-0.02	-0.04	31.3	-0.87	0.25	-0.18		
15:45	10824	4.1	4.1	7.8	4.4	-0.02	-0.04	32.3	-0.87	0.25	-0.18		
15:49	9929	3.6	3.2	6.7	4.3	-0.01	-0.03	34.2	-0.88	0.26	-0.14		
15:52	9025	4.1	3.5	5.8	4.7	-0.01	-0.03	36.1	-0.88	0.26	-0.13		
15:54	8121	3.3	3.3	5.6	4.5	0.00	-0.02	33.7	-0.88	0.25	-0.13		
15:57	7215	3.5	3.5	5.0	4.6	-0.01	-0.01	34.6	-0.88	0.25	-0.13		
16:07	0	------	------	------	------	-0.10	-0.10	0.0	-0.86	-0.63	-0.58		

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記録 RECORDED BY　　日付 DATE

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蒸気タービン運転記録

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STEAM TURBINE RUNNING TEST RECORD (2/3)

PAGE : 1

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	TC-9901	R0215708	SRV-5DF

回転方向（蒸気入口側から見て） DIRECTION OF ROTATION (facing STEAM end) : 時計 CW	ロータ ROTOR : B 8	起動 START 10:08	停止 STOP 16:07

時刻 TIME	回転数 SPEED min⁻¹	軸受給油圧 LUBE OIL PRESS. kgf/cm²G	コントロール油給油圧 CONTROL OIL PRESS. kgf/cm²G	軸受給油温度 LUBE OIL INLET TEMP ℃	軸受戻り油温度 高圧側 LUBE DRAIN TEMP. (HP SIDE) ℃	軸受戻り油温度 低圧側 LUBE DRAIN TEMP. (LP SIDE) ℃	主蒸気温度 INLET STEAM TEMP. ℃	シール蒸気温度 SEAL STEAM TEMP. ℃	排気温度 EXHAUST STEAM TEMP. ℃				
9:35	0	1.18	9.47	43.6	42.6	38.4	16.8	17.1	17.0				
10:07	20	1.15	8.13	47.7	47.2	45.6	235.8	28.0	16.8				
10:16	1024	1.16	7.88	46.7	46.6	44.6	239.0	137.4	46.7				
10:36	2956	1.14	8.57	46.6	49.0	46.3	246.9	140.6	45.8				
10:49	7213	1.11	7.83	46.7	57.3	55.6	237.2	141.1	46.5				
10:59	10828	1.11	7.81	46.7	68.1	67.9	234.6	141.1	47.4				
11:03	11904	1.11	7.62	46.6	72.4	72.1	235.2	140.8	49.6				
11:09	7219	1.12	7.79	46.7	57.8	59.7	241.2	141.1	52.8				
11:14	8127	1.15	7.78	46.7	59.2	60.0	239.8	141.2	52.4				
11:16	9022	1.16	7.77	46.6	61.4	61.5	242.3	141.0	52.3				
11:18	9922	1.16	7.77	46.5	63.9	63.9	242.6	141.2	53.4				
11:21	10826	1.17	7.75	46.7	67.4	67.4	243.8	141.1	55.9				
11:27	11789	1.17	7.75	46.7	71.6	72.4	247.8	141.3	59.8				
11:42	11788	1.16	7.70	46.4	71.8	74.2	257.0	141.5	63.2				
11:45	10826	1.15	7.71	46.5	68.1	70.6	257.3	141.1	65.4				
12:00	10827	1.15	7.69	46.4	67.8	70.3	263.5	141.2	64.3				
12:15	10824	1.16	7.66	46.4	67.8	70.3	268.2	141.7	66.1				

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審査 TEST ENGINEER 日付 DATE

N.ISHIKAWA 03/10/15

記録 RECORDED BY 日付 DATE

T.NISHIYAMA 03/10/15

蒸気タービン運転記録

STEAM TURBINE RUNNING TEST RECORD (2/3)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	TC-9901	R0215708	SRV-5DF

回転方向（蒸気入口側から見て） DIRECTION OF ROTATION (facing STEAM end) : 時計 CW　　ロータ ROTOR : B　　起動 START 10:08　　停止 STOP 16:07

時刻 TIME	回転数 SPEED min⁻¹	軸受給油圧 LUBE OIL PRESS. kgf/cm²G	コントロール油 給油圧 CONTROL OIL PRESS. kgf/cm²G	軸受給油温度 LUBE OIL INLET TEMP ℃	軸受戻り油温度 高圧側 LUBE DRAIN TEMP. (HP SIDE) ℃	軸受戻り油温度 低圧側 LUBE DRAIN TEMP. (LP SIDE) ℃	主蒸気温度 INLET STEAM TEMP. ℃	シール蒸気温度 SEAL STEAM TEMP. ℃	排気温度 EXHAUST STEAM TEMP. ℃				
12:30	10828	1.19	7.77	46.5	67.7	70.1	270.6	141.8	68.0				
12:45	10828	1.19	7.75	46.5	67.8	70.0	272.6	141.3	69.3				
13:00	10828	1.26	7.76	43.1	64.9	67.9	274.1	141.3	69.7				
13:06	10828	1.30	7.74	42.6	64.3	67.2	274.3	141.6	70.2				
13:15	10827	1.30	7.72	42.5	64.1	67.0	275.0	141.4	71.2				
13:21	10828	1.28	7.73	42.5	64.0	66.9	275.9	141.6	71.2				
13:30	10825	1.19	7.67	45.7	66.9	69.0	275.9	141.5	72.4				
13:43	10826	1.04	7.63	49.1	70.8	72.5	276.2	141.4	74.7				
13:45	10825	1.03	7.62	49.5	71.2	72.8	276.6	141.5	75.3				
13:58	10826	1.04	7.59	49.9	71.7	73.6	277.2	141.9	76.8				
14:00	10827	1.03	7.60	49.9	71.8	73.6	276.9	141.7	77.1				
14:15	10828	1.17	7.64	46.2	68.0	70.5	277.5	141.9	76.8				
14:30	10828	1.17	7.58	46.0	67.8	70.3	278.4	141.3	77.7				
14:45	10827	1.16	7.58	46.1	67.9	70.3	278.7	141.6	78.6				
15:00	10827	1.17	7.56	46.2	67.9	70.3	278.2	141.6	79.2				
15:15	10825	1.17	7.54	46.2	67.9	70.3	278.6	142.1	80.0				
15:30	10827	1.17	7.54	46.1	67.9	70.3	278.3	141.8	80.6				
15:45	10824	1.15	7.50	46.2	67.9	70.5	278.9	141.7	80.8				
15:49	9929	1.16	7.48	46.1	65.1	68.0	278.1	141.8	81.5				
15:52	9025	1.17	7.48	46.1	62.4	65.0	277.0	141.7	79.9				
15:54	8121	1.17	7.48	46.1	60.1	63.2	275.3	141.9	80.0				
15:57	7215	1.18	7.47	46.2	57.8	60.4	272.9	141.3	77.5				
16:07	0	1.22	7.99	46.0	46.8	48.2	239.5	103.1	64.5				

LG E&C INSPECTION TEAM ☑WITNESSED ☐REVIEWED Oct. 15, 2003

御立会者 WITNESSED BY　　日付 DATE

審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA　　03/10/15

記録 RECORDED BY　　日付 DATE

T.NISHIYAMA　　03/10/15

蒸気タービン運転記録

32

STEAM TURBINE RUNNING TEST RECORD (3/3)

PAGE : 1

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	TC-9901	R0215708	SRV-5DF

回転方向（蒸気入口側から見て） DIRECTION OF ROTATION (facing STEAM end) : 時計 CW　　ロータ ROTOR : B B　　起動 START 10:08　　停止 STOP 16:07

時刻 TIME	回転数 SPEED min⁻¹	ジャーナル軸受温度 高圧側 JNL.BRG TEMP. (HP SIDE) ℃	ジャーナル軸受温度 高圧側 JNL.BRG TEMP. (HP SIDE) ℃	ジャーナル軸受温度 低圧側 JNL.BRG TEMP. (LP SIDE) ℃	ジャーナル軸受温度 低圧側 JNL.BRG TEMP. (LP SIDE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 反負荷側 THRUST. BRG TEMP. (INACTIVE) ℃	スラスト軸受温度 反負荷側 THRUST. BRG TEMP. (INACTIVE) ℃			
9:35	0	41.4	41.4	41.5	41.2	42.8	42.7	42.5	42.7	43.0			
10:07	20	46.4	46.5	46.6	46.5	47.7	47.7	47.6	47.7	47.9			
10:16	1024	50.6	51.1	51.7	52.0	49.8	48.8	49.3	47.2	47.4			
10:36	2956	62.3	60.4	64.4	63.8	53.1	51.9	52.1	48.2	48.8			
10:49	7213	81.3	69.9	85.7	81.8	58.7	57.6	58.1	52.4	53.1			
10:59	10828	89.7	77.3	99.6	95.4	65.7	64.9	64.8	56.9	57.5			
11:03	11904	90.2	81.2	103.0	97.8	68.8	67.8	67.7	58.8	59.7			
11:09	7219	78.2	68.3	84.5	81.9	57.0	57.0	57.0	53.0	53.5			
11:14	8127	81.3	69.5	88.3	85.0	58.4	58.5	58.3	53.9	54.4			
11:16	9022	84.9	70.8	92.0	88.8	60.3	60.3	59.9	55.0	55.5			
11:18	9922	87.8	72.5	96.0	92.1	62.3	62.1	61.6	55.9	56.6			
11:21	10826	89.0	75.4	99.6	95.2	64.4	63.8	63.7	56.7	57.4			
11:27	11789	90.0	79.9	103.0	97.4	67.1	66.5	66.3	58.5	59.4			
11:42	11788	89.2	79.3	102.7	97.6	65.8	65.5	65.0	58.3	59.2			
11:45	10826	87.4	74.8	98.8	95.5	62.8	62.9	62.3	57.1	57.7			
12:00	10827	87.7	75.0	99.0	95.5	62.4	62.6	62.1	57.2	57.8			
12:15	10824	87.7	75.0	99.1	95.5	62.0	62.4	61.6	57.0	57.8			

LG E&C INSPECTION TEAM ☑WITNESSED ☐REVIEWED Oct. 15, 2003

御立会者 WITNESSED BY　　日付 DATE

/ /

審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA N. Ishikawa 03/10/15

記録 RECORDED BY　　日付 DATE

T.NISHIYAMA T. Nishiyama 03/10/15

蒸気タービン運転記録

STEAM TURBINE RUNNING TEST RECORD (3/3)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	TC-9901	R0215708	SRV-5DF

回転方向（蒸気入口側から見て） DIRECTION OF ROTATION (facing STEAM end) : 時計 CW　　ロータ ROTOR : B B　　起動 START 10:08　　停止 STOP 16:07

時刻 TIME	回転数 SPEED min⁻¹	ジャーナル軸受温度 高圧側 JNL.BRG TEMP. (HP SIDE) ℃	ジャーナル軸受温度 高圧側 JNL.BRG TEMP. (HP SIDE) ℃	ジャーナル軸受温度 低圧側 JNL.BRG TEMP. (LP SIDE) ℃	ジャーナル軸受温度 低圧側 JNL.BRG TEMP. (LP SIDE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 反負荷側 THRUST. BRG TEMP. (INACTIVE) ℃	スラスト軸受温度 反負荷側 THRUST. BRG TEMP. (INACTIVE) ℃			
12:30	10828	87.6	74.7	99.0	95.4	61.8	62.4	61.4	57.2	57.8			
12:45	10828	87.6	74.7	99.1	95.3	61.5	62.2	61.3	57.1	57.8			
13:00	10828	87.8	71.6	98.6	94.5	58.8	59.5	58.6	54.5	55.5			
13:06	10828	87.8	71.1	98.8	94.3	58.3	59.1	58.1	54.1	55.1			
13:15	10827	87.7	70.9	98.8	94.1	58.0	58.9	57.9	54.0	55.0			
13:21	10828	87.7	70.9	98.7	94.2	58.1	58.9	57.8	53.9	55.0			
13:30	10825	87.6	74.0	99.2	95.1	60.7	61.3	60.4	56.5	57.3			
13:43	10826	88.6	78.9	100.0	95.6	63.8	64.1	63.3	59.5	60.2			
13:45	10825	88.6	79.3	99.8	95.7	64.2	64.5	63.8	59.8	60.4			
13:58	10826	88.5	79.5	99.7	96.0	64.5	64.6	63.9	60.0	60.6			
14:00	10827	88.5	79.5	99.7	95.9	64.6	64.7	63.9	60.0	60.7			
14:15	10828	87.1	74.5	99.0	95.4	61.0	61.5	60.7	57.1	57.8			
14:30	10828	87.1	74.4	98.8	95.1	61.0	61.5	60.7	57.0	57.6			
14:45	10827	87.0	74.3	98.8	95.1	61.0	61.4	60.6	57.0	57.6			
15:00	10827	87.0	74.4	99.0	95.2	61.1	61.4	60.7	57.0	57.6			
15:15	10825	87.0	74.4	98.7	95.2	61.1	61.4	60.7	56.9	57.6			
15:30	10827	87.0	74.4	98.8	95.2	61.1	61.3	60.7	57.0	57.7			
15:45	10824	87.0	74.4	98.7	95.2	61.1	61.4	60.8	56.9	57.7			
15:49	9929	85.9	72.5	95.2	92.3	59.0	60.0	59.0	55.9	56.4			
15:52	9025	83.6	70.3	91.5	89.0	57.4	58.5	57.6	55.0	55.1			
15:54	8121	80.5	69.1	88.1	85.2	55.9	56.8	56.1	54.0	54.1			
15:57	7215	77.2	67.7	84.1	81.7	54.5	55.2	54.9	52.9	53.1			
16:07	0	49.1	50.1	49.7	50.3	46.9	46.8	46.9	47.1	46.8			

LG E&C
INSPECTION TEAM
☑ WITNESSED ☐ REVIEWED
Oct. 15, 2003

御立会者 WITNESSED BY　　日付 DATE

/ /

審査 TEST ENGINEER　　日付 DATE

N. ISHIKAWA　　03/10/15

記録 RECORDED BY　　日付 DATE

T. NISHIYAMA　　03/10/15

3 Record for Turbine

3-2 Vibration Amplitude Record

a **Bode Plot of Start up**

[Note]

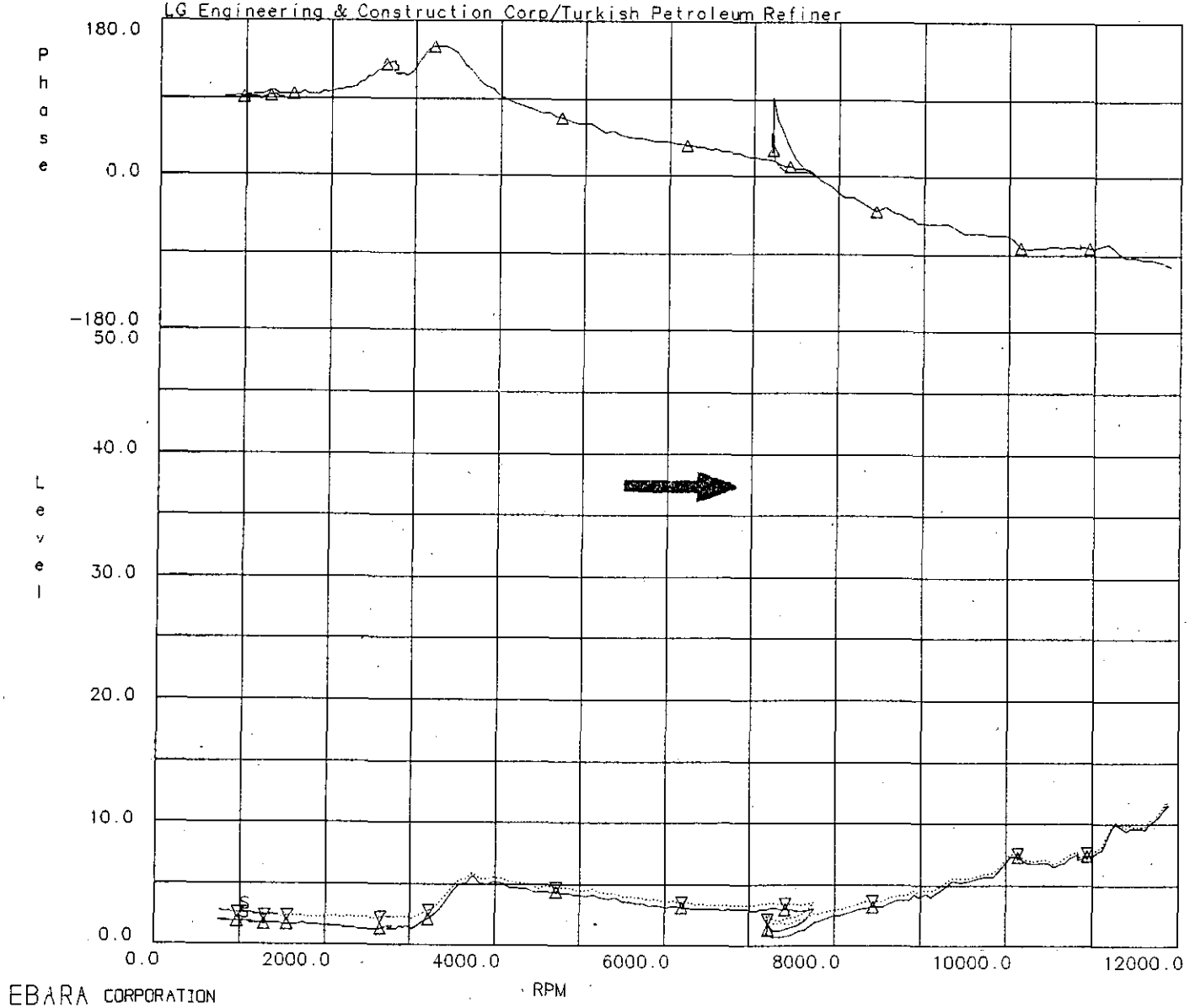
T.SE.X	:	Steam End X
T.SE.Y	:	Steam End Y
T.EE.X	:	Exhaust End X
T.EE.Y	:	Exhaust End Y

EO : 1.0	:	Synchronous Frequency
TOTAL	:	Overall
Unit	.	Vibration : μ m p-p
.	.	Phase : Degree
.	.	.

R0215708
25MB5

SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
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Oct. 15, 2003
I.G E&C

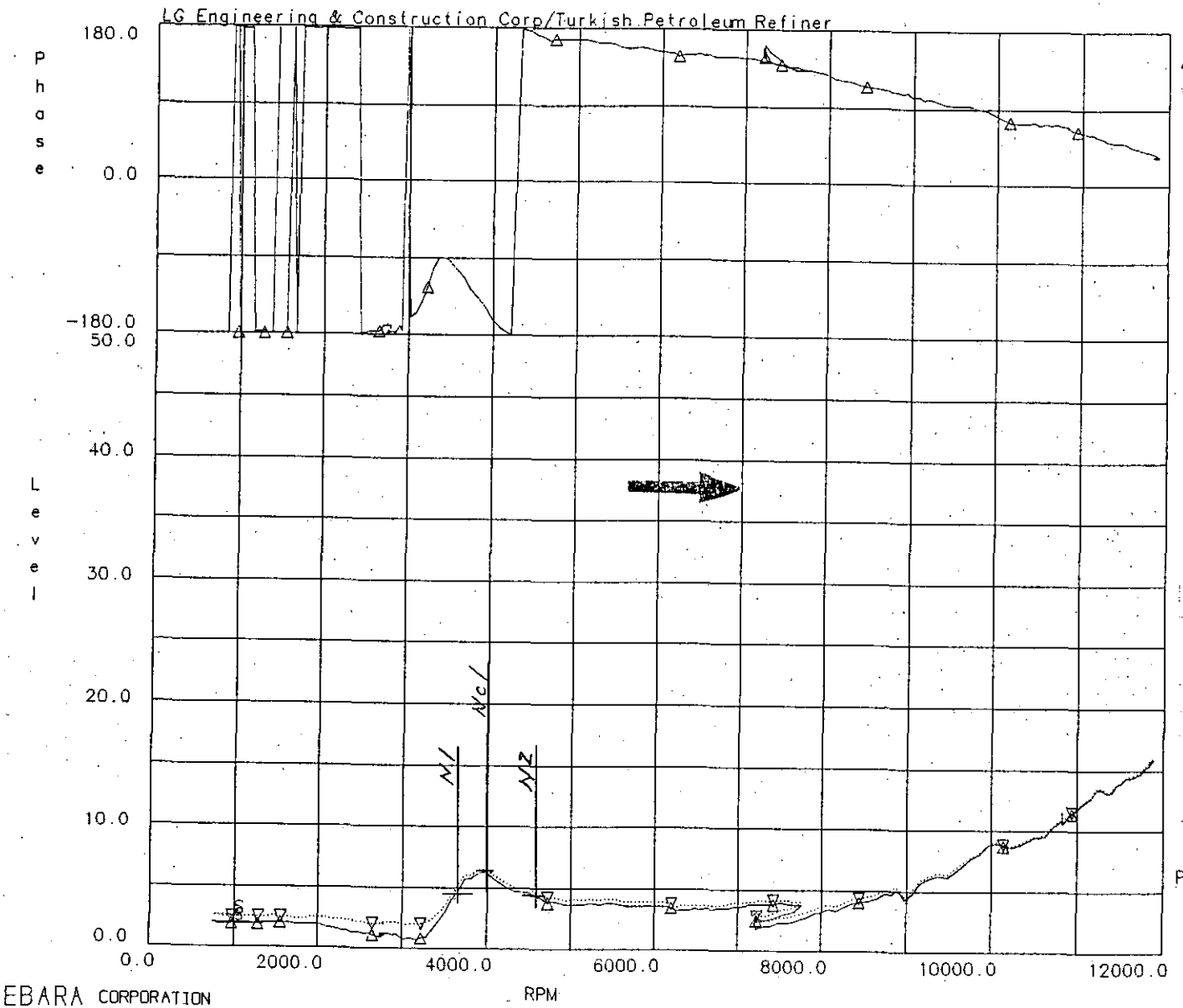
EBARA CORPORATION

Wed Oct 15 10:06:29 2003

R0215708
25MB5

SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



AF = Nc.1 / (N2-N1)
= 3997 / (4605 - 3652)
= **4.19**

SM ≧ 100 - (84 + 6 / (AF - 3))
≧ 100 - (84 + 6 / (4.19 - 3))
≧ **11.0 %**

SM test = (Nmin - Nc.1) / Nmin
=(7218 - 3997) / 7218
= **44.6 %**

(Min.Speed = 7218 rpm)

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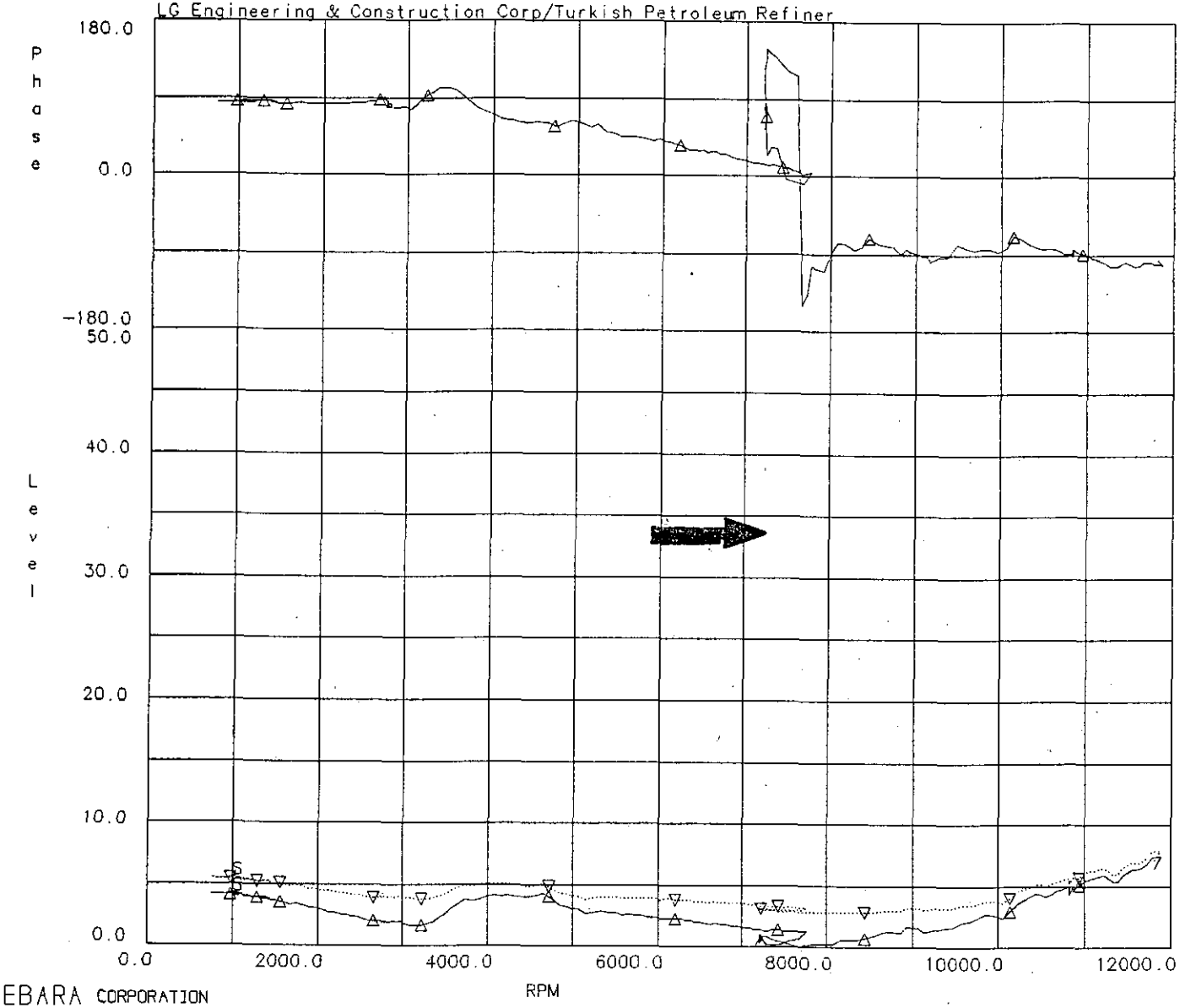
LG Engineering & Construction Corp/Turkish Petroleum Refiner



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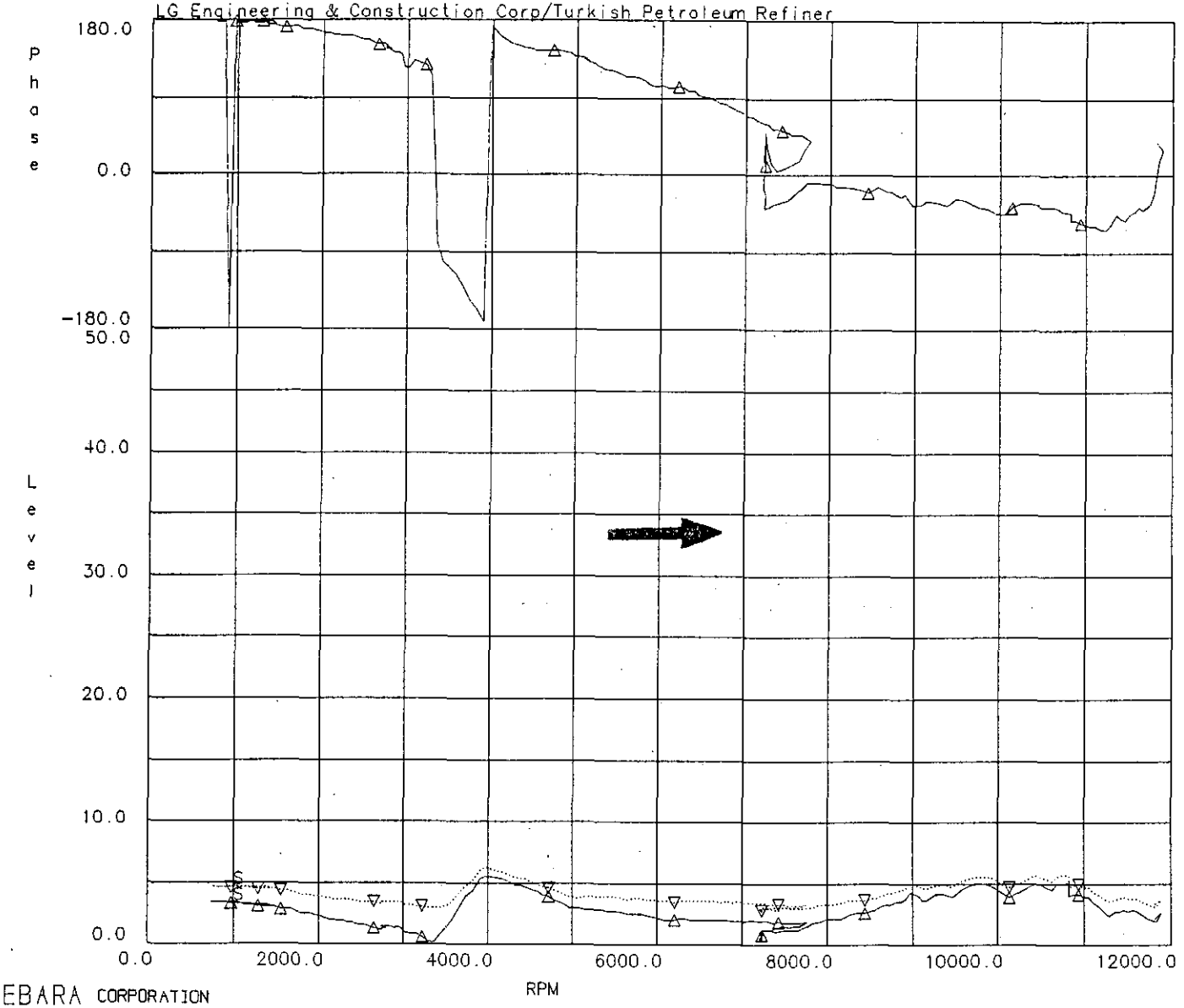
3-3

R0215708
25MB5

SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



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Oct. 15, 2003

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3 Record for Turbine

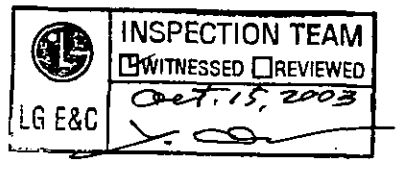
3-2 Vibration Amplitude Record

b Bode Plot of Coast Down

[Note]

T.SE.X	:	Steam End X
T.SE.Y	:	Steam End Y
T.EE.X	:	Exhaust End X
T.EE.Y	:	Exhaust End Y

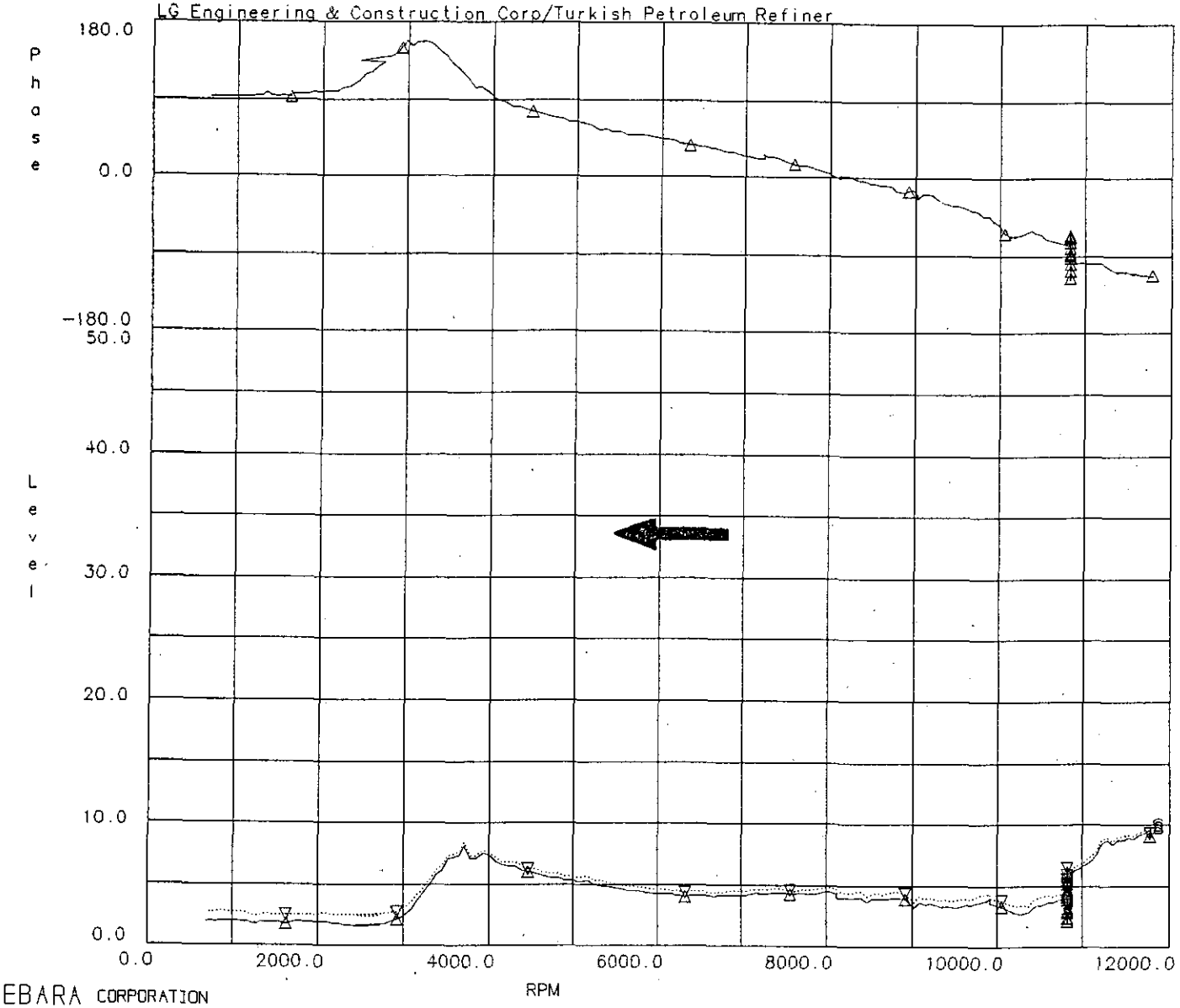
EO : 1.0	:	Synchronous Frequency
TOTAL	:	Overall
Unit	.	Vibration : μ m p-p
.	.	Phase : Degree
.	.	.



R0215708
25MB5

SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
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LG E&C
Oct. 15, 2003

EBARA CORPORATION

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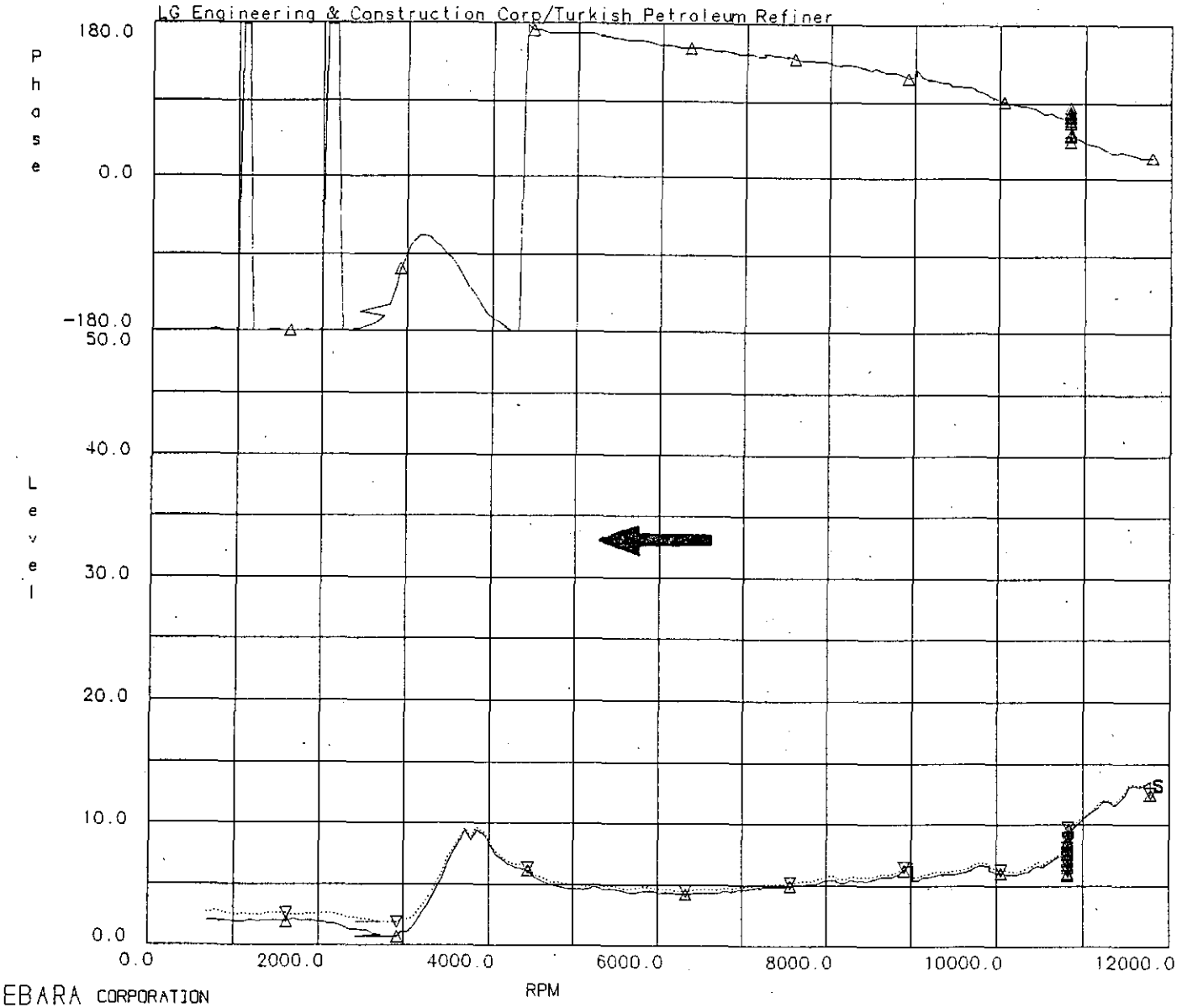
LG Engineering & Construction Corp/Turkish Petroleum Refiner



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Oct. 15, 2003
LG E&C

EBARA CORPORATION

Wed Oct 15 10:06:29 2003

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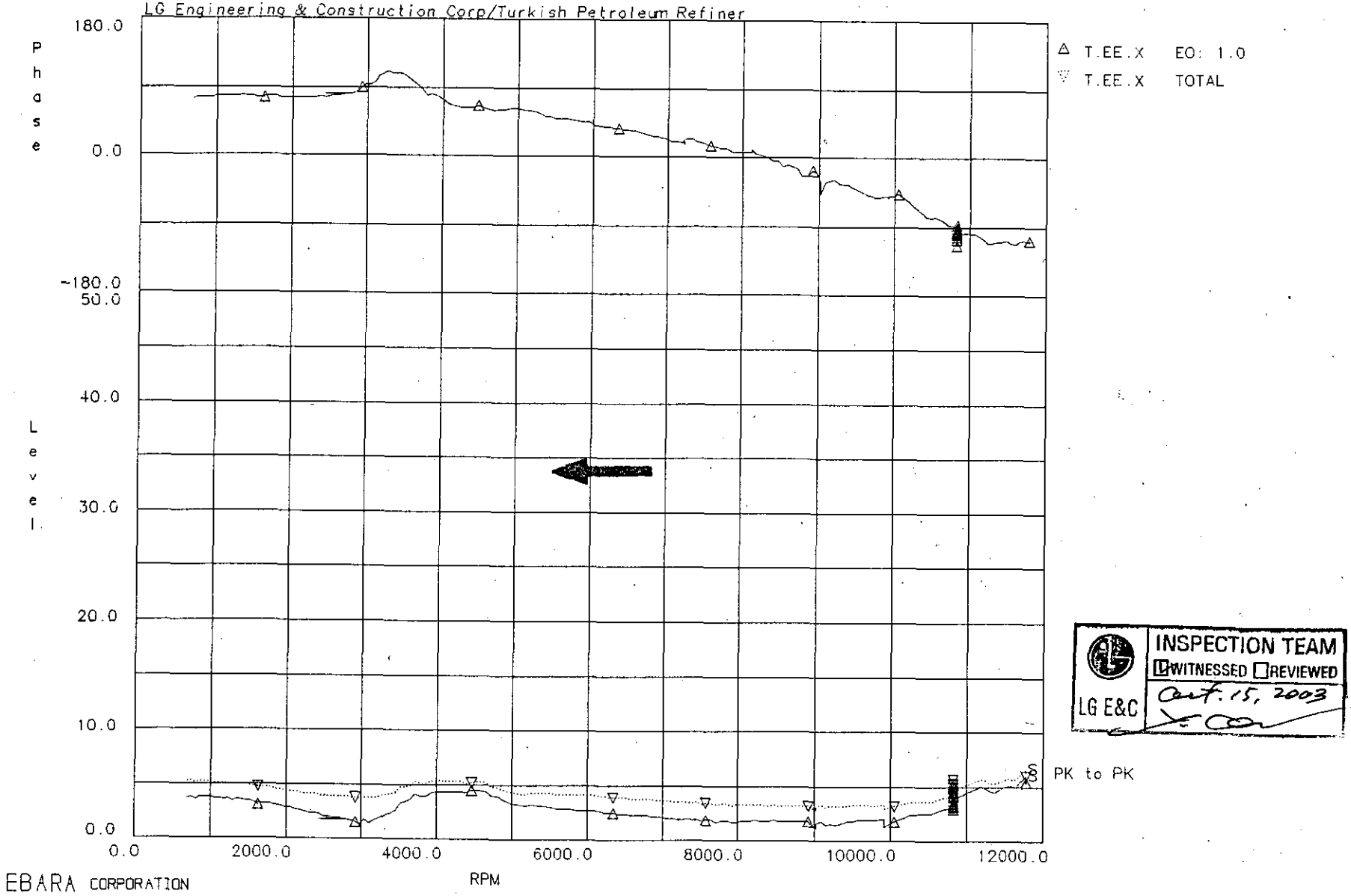

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LG E&C
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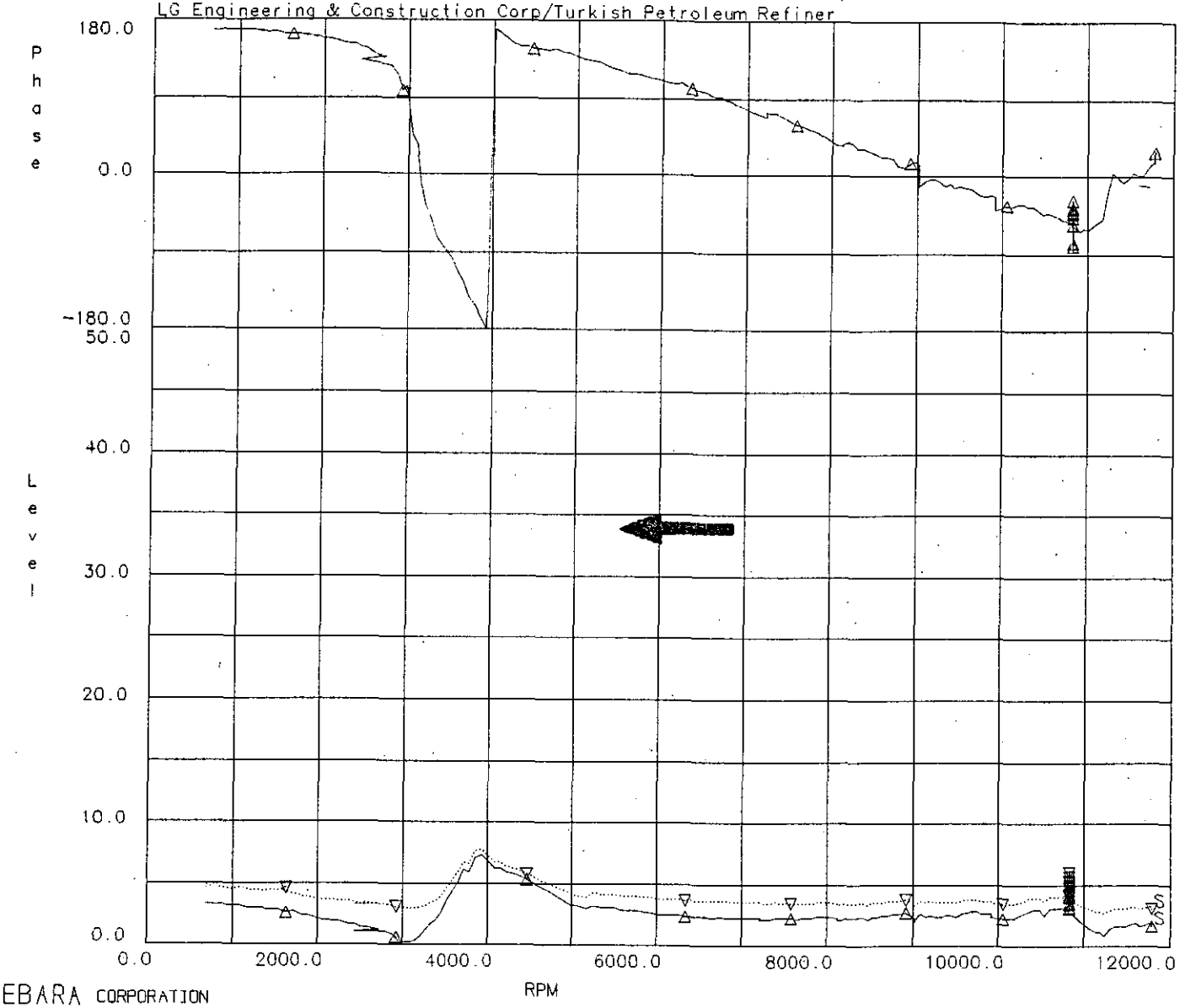
LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
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LG E&C
Oct. 15, 2003

EBARA CORPORATION

Wed Oct 15 10:06:29 2003

3 Record for Turbine

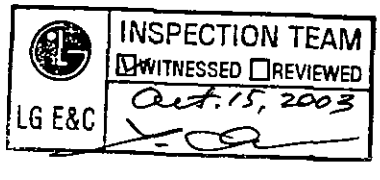
3-3 Vibration Sweep Record

at MCS

[Note]

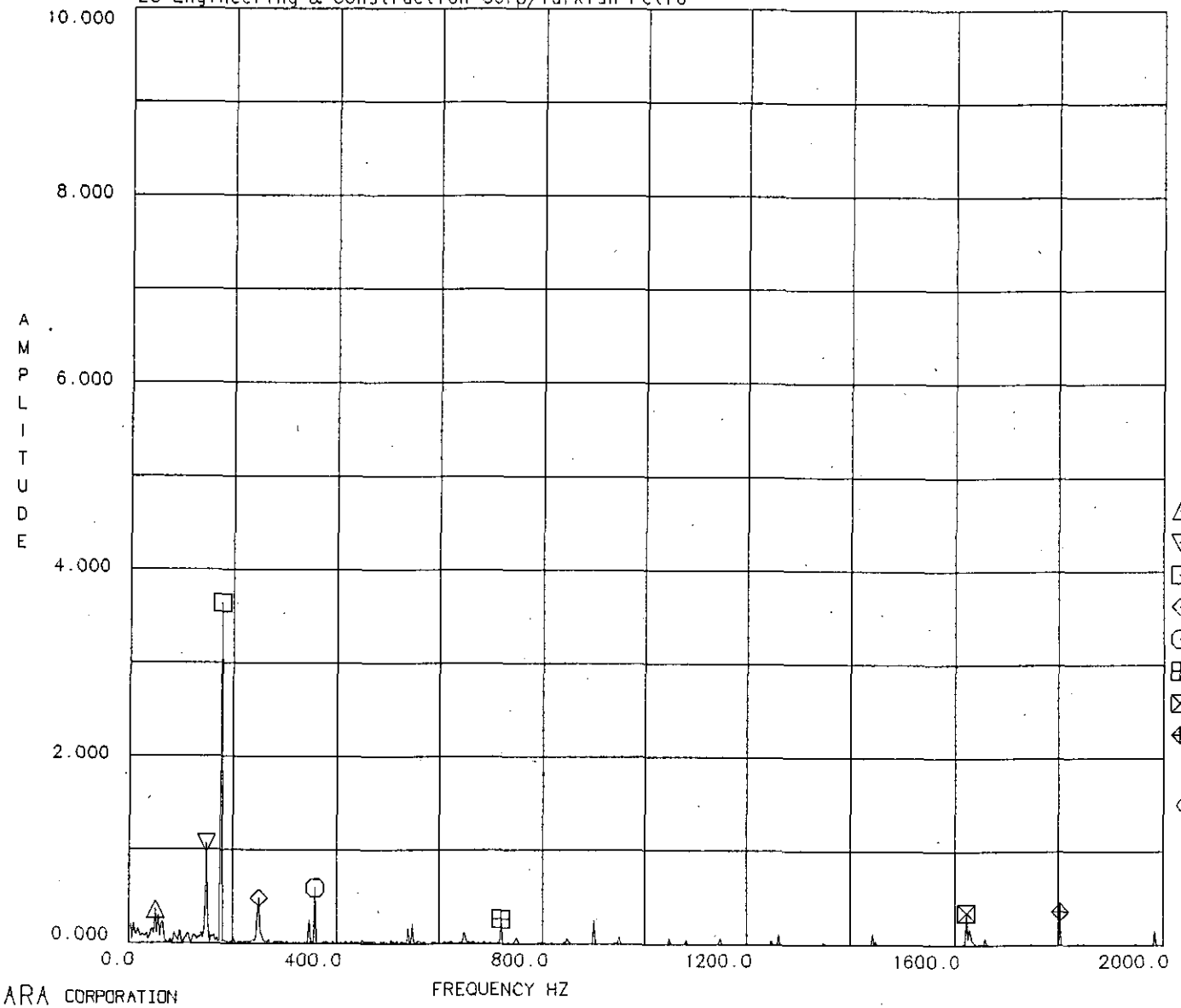
T.SE.X	:	Steam End X
T.SE.Y	:	Steam End X
T.EE.X	:	Exhaust End X
T.EE.Y	:	Exhaust End Y

unit : μm p-p



R0215708
25MB5

SRV-5DF
LG Engineering & Construction Corp/Turkish Petro



T.SE.X

P-P

N1 rpm10827
TIME 14:44:27

	FREQ	AMP
△	51	0.364
▽	152	1.066
□	180	3.652
◇	251	0.492
○	361	0.603
⊞	722	0.275
⊠	1624	0.356
⊕	1805	0.367

Overall 4.15

LG E&C
INSPECTION TEAM
☑WITNESSED ☐REVIEWED
Oct. 15. 2003

EBARA CORPORATION

Wed Oct 15 10:06:29 2003

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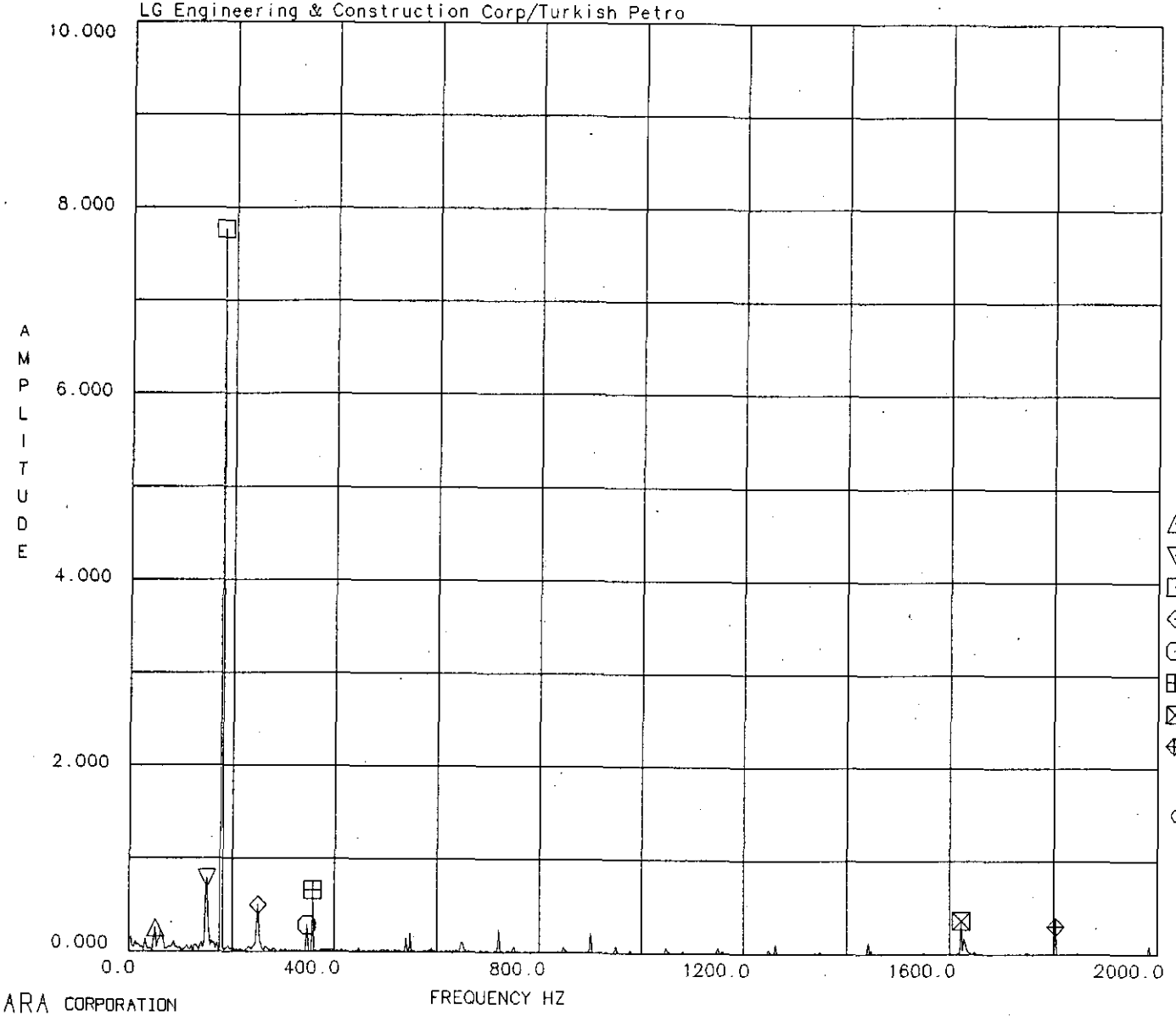
R0215708
25MB5

SRV-5DF
LG Engineering & Construction Corp/Turkish Petro



T.SE.Y

P-P

N1 rpm10827
TIME 14:44:27

	FREQ	AMP
△	51	0.255
▽	152	0.794
□	180	7.781
◇	251	0.504
○	350	0.285
⊞	361	0.671
⊠	1624	0.361
⊕	1805	0.304

Overall 7.99

LG E&C
INSPECTION TEAM
☐WITNESSED ☐REVIEWED
Oct. 15, 2003

EBARA CORPORATION

Wed Oct 15 10:06:29 2003

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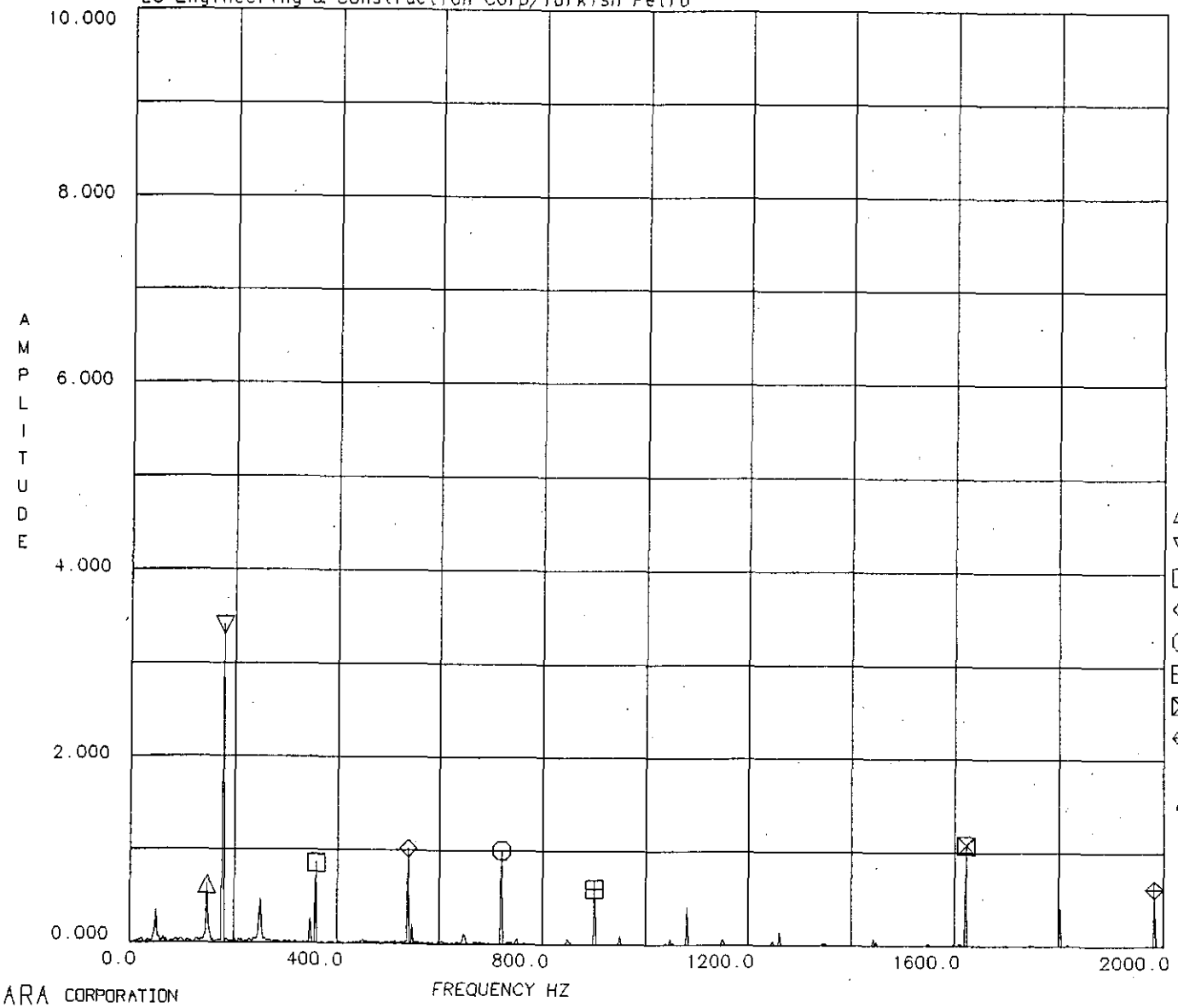
R0215708
25MB5

SRV--5DF
LG Engineering & Construction Corp/Turkish Petro



T.EE.X

P-P

N1 rpm10827
TIME 14:44:27

	FREQ	AMP
△	149	0.640
▽	180	3.415
□	361	0.868
◇	541	1.024
○	722	1.007
⊞	902	0.599
⊠	1624	1.081
⊕	1985	0.617

Overall 4.27

LG E&C
INSPECTION TEAM
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Oct. 15, 2003

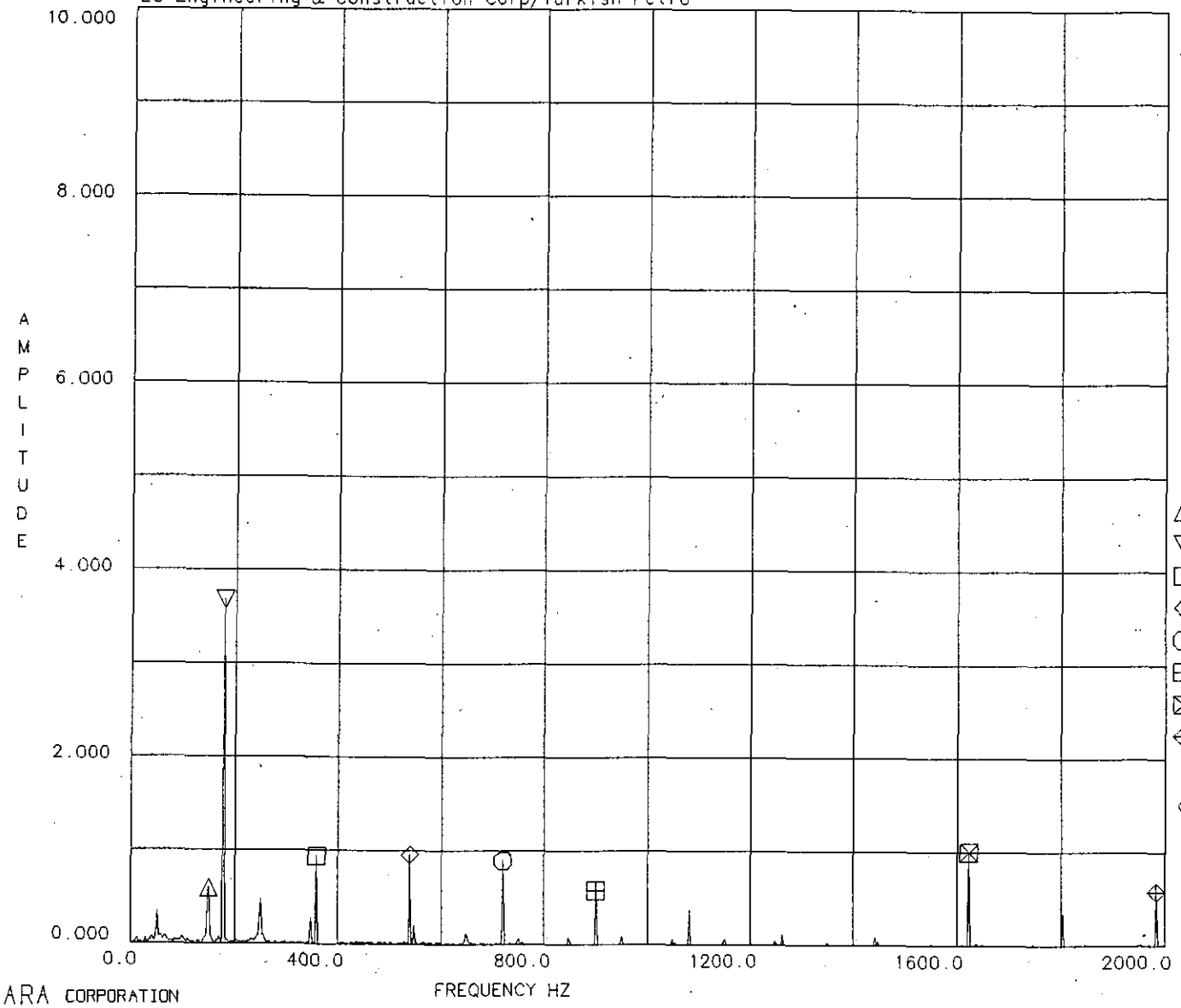
EBARA CORPORATION

Wed Oct 15 10:06:29 2003

47

R0215708
25MB5

SRV-5DF
LG Engineering & Construction Corp/Turkish Petro



T.EE.Y

P-P

N1 rpm10827
TIME 14:44:27

	FREQ	AMP
△	152	0.608
▽	180	3.685
□	361	0.953
◇	541	0.962
○	722	0.897
⊞	902	0.583
⊠	1624	1.006
⌖	1985	0.583

Overall 4.47

LG E&C
INSPECTION TEAM
☒ WITNESSED ☐ REVIEWED
Oct. 15, 2003

EBARA CORPORATION

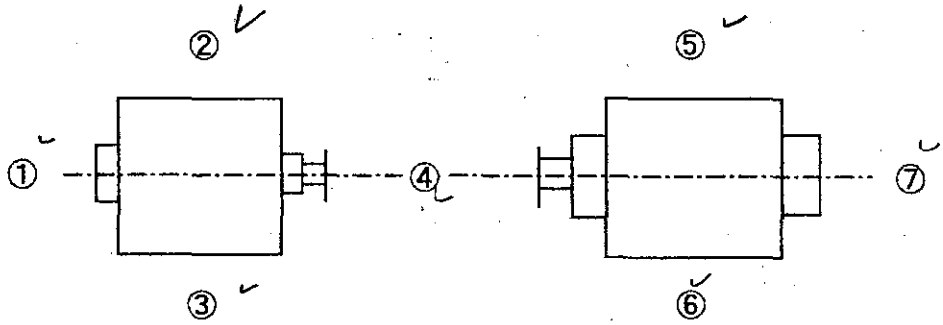
Wed Oct 15 10:06:29 2003

4 Sound Level Record (reference only)

INSPECTION TEAM
☒ WITNESSED ☐ REVIEWED
Oct. 15, 2003
LG E&C

騒音記録
SOUND LEVEL RECORD

顧客名 CUSTOMER	アイテム NO. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp. Turkish Petroleum Refineries Corp.	CT-9901/TC-9901	R0215708	25MB5/SRV-5DF



単位(UNIT): dB (A)

時刻 TIME	回転数 SPEED min-1	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
		81	81	81	83	82	83	82			

時刻 TIME	回転数 SPEED min-1	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩

スケール (A)
SCALE

測定器 INSTRUMENT : RION NA-20

測定高さ (m) MEASURING HEIGHT : SHAFT CENTER

測定距離 (m) MEASURING DISTANCE : 1 m

暗騒音 dB(A) BACKGROUND NOISE 76 dB(A)

LG E&C INSPECTION TEAM ☒WITNESSED ☐REVIEWED Oct. 15, 2003

御立会者 WITNESSED BY 日付 DATE

審査 TEST ENGINEER H. Tsutsumi 日付 DATE Oct 15 '03

記録 RECORDED BY 日付 DATE Oct. 15 '03

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

5 Calibration Record

CALIBRATION RECORD (VIBRATION MONITOR[redacted] SYSTEM)

振動計測システム検定記録

DATE (日付) : 2003/3/19

SYSTEM NO.(システムNo.) : B

INSTRUMENT	CASE	1		2		3		4		5		6	
FFT.Ch.A	FREQ'CY OF KEY PHASER キー周波数 (Hz)	100		100		300		300		750		750	
	VOLTAGE キー設定電圧値 (V)	4.95 (SET5V)		4.96 (SET5V)		4.96 (SET5V)		4.96 (SET5V)		4.97 (SET5V)		4.96 (SET5V)	
FFT.Ch.B	FREQ'CY OF VIBRATION 振動周波数 (Hz)	100		100		300		300		750		750	
	VOLTAGE 振動設定電圧値 (mV)	788.82		394.88		788.19		395.67		788.27		394.65	
	VIBRATION VALUE 振動測定値 (μm)	100.18 (SET100μm)		50.15 (SET50μm)		100.1 (SET100μm)		50.25 (SET50μm)		100.11 (SET100μm)		50.12 (SET50μm)	
VIBRATION VALUE (DIGTAL MULTI METER) デジタルマルチメーター振動測定値 (X) (μm)		100.10		50.12		100.01		50.23		100.22		50.04	
検定記録 CALIBRATION RECORD		READING (μm)	RATIO Y/X	READING (μm)	RATIO Y/X	READING (μm)	RATIO Y/X	READING (μm)	RATIO Y/X	READING (μm)	RATIO Y/X	READING (μm)	RATIO Y/X
EDAS値 (Y)	CH.1	101.33	1.012	50.28	1.003	100.82	1.008	50.35	1.002	102.02	1.018	50.73	1.014
	CH.2	102.24	1.021	49.88	0.995	100.24	1.002	50.66	1.009	101.22	1.010	50.91	1.017
	CH.3	101.23	1.011	50.00	0.998	100.35	1.003	50.26	1.001	100.62	1.004	50.62	1.012
	CH.4	99.96	0.999	50.75	1.013	99.64	0.996	50.50	1.005	100.60	1.004	50.81	1.015
	CH.5	99.71	0.996	50.21	1.002	99.44	0.994	50.67	1.009	100.90	1.007	50.61	1.011
	CH.6	98.53	0.984	50.57	1.009	100.43	1.004	50.54	1.006	99.85	0.996	50.56	1.010
	CH.7	99.21	0.991	49.93	0.996	100.17	1.002	50.38	1.003	100.47	1.003	50.87	1.017
	CH.8	99.96	0.999	49.95	0.997	100.04	1.000	51.11	1.018	101.02	1.008	50.81	1.015
	CH.9	100.23	1.001	50.19	1.001	100.85	1.008	50.80	1.011	100.08	0.999	50.70	1.013
	CH.10	101.91	1.018	50.74	1.012	100.09	1.001	50.55	1.006	101.50	1.013	50.78	1.015
	CH.11	100.46	1.004	50.17	1.001	100.00	1.000	51.09	1.017	100.37	1.002	50.56	1.010
	CH.12	101.18	1.011	50.19	1.001	100.75	1.007	50.14	0.998	100.53	1.003	50.56	1.010
	CH.13	101.26	1.012	49.96	0.997	101.01	1.010	50.00	0.995	100.90	1.007	50.22	1.004
	CH.14	100.13	1.000	50.04	0.998	99.92	0.999	50.57	1.007	100.43	1.002	51.02	1.020
	CH.15	99.73	0.996	50.28	1.003	99.82	0.998	50.68	1.009	100.65	1.004	50.62	1.012
	CH.16	99.93	0.998	50.21	1.002	99.77	0.998	51.23	1.020	100.32	1.001	50.92	1.018

ACCURACY
(合格基準) ± 3% of measured value

JUDGE
(判定) APPROVAL

APPROVED BY
承認 N.Ishikawa
2003/3/19

CHECKED BY
担当 S.Suzuki
2003/3/19

計器検定成績書
INSTRUMENT TEST CERTIFICATE

管理番号
Manage No. 94H3725−5

型式
Type デジタル回転計 TM-820

測定範囲
Range 0 ～ 99999min-1

最大許容差 Tolerance of Accuracy	3 Hz ～ 20 kHz	表示値 X (±0.02%) ± 1digit
	1 Hz ～ 3 Hz	表示値 X (±0.15%) ± 1digit
	0.1 Hz ～ 1 Hz	表示値 X (±0.08%) ± 1digit

基準器
Standard Instrument

型式 Type	FS-121A Digital Synthesizer	管理番号 Manage No.	SG−(1)-015

試験状態
Test Conditions

室温
Ambient Temp. 21℃

入力信号 7200 シリーズ

Frequency Input 入力周波数 (Hz)	Data 計測回転数 (r/min)	Result 校正結果
0.1	6	Acceptable 合格
10	600	
100	6000	
1000	60000	
1600	96000	

入力信号 MP-910
入力パルス数:60P/R 分周設定:60P/R

Frequency Input 入力周波数 (Hz)	Data 計測回転数 (r/min)	Result 校正結果
200	200	Acceptable 合格
1000	999	
10000	9999	
20000	20000	

入力信号 MP-981・LG-916
入力パルス数:60P/R 分周設定:60P/R

Frequency Input 入力周波数 (Hz)	Data 計測回転数 (r/min)	Result 校正結果
6	6	Acceptable 合格
10	10	
100	100	
1000	999	
10000	9999	
20000	19999	

試験者 Tested By S.Suzuki
試験日 Date '03/3/5

様式－1

検査年月日 平成15年08月27日	検査成績書	発行元 日本電子応用(株) 大阪FEセンター
温度 22 ℃	機器名：ﾊｲﾌﾞﾘｯﾄﾞﾚｺｰﾀﾞ	検査責任者 溝口 保男
湿度 64 %	機器形式：RD3500 製造番号：4030365	担当者 伊達 勉

検査項目	定格 及び 検査項目（条件）	判定
① 外観・機構	組み立て、ネジ締め付けの緩みがない。 スイッチ等が正常である。	合格
② 絶縁抵抗	AC電源入力端子 ― ｱｰｽ端子間 DV500Vﾒｶﾞｰにて100MΩ以上	合格
	A/D変換器ﾕﾆｯﾄが1台実装されている場合 ・ｽｷｬﾅｺﾈｸﾀｱﾅﾛｸﾞ部(A/D1) ― ｱｰｽ端子間 DC500Vﾒｶﾞｰにて100MΩ以上	／
	A/D変換器ﾕﾆｯﾄが2台実装されている場合 ・ｽｷｬﾅｺﾈｸﾀｱﾅﾛｸﾞ部(A/D2) ― ｱｰｽ端子間 ・ｽｷｬﾅｺﾈｸﾀｱﾅﾛｸﾞ部(A/D1) ― ｽｷｬﾅｺﾈｸﾀｱﾅﾛｸﾞ部(A/D2) DC500Vﾒｶﾞｰにて100MΩ以上	合格
③ 記録部動作	ﾃｽﾄﾊﾟﾀｰﾝ Y-T記録動作確認 FEED 記録紙空送り動作確認 ﾍﾟｰﾊﾟｰｱｳﾄ 記録紙残量検出動作確認	合格
④ 性能	下記仕様を全て満たすこと ・直流電圧 積分時間:40/50/100ms（下表1） 積分時間:16.7/20ms（下表2）	合格

積分時間:40/50/100ms

レンジ	確度	分解能
± 20 mV	±0.02%rdg ±5digit	1 μV
± 200 mV	±0.02%rdg ±4digit	10 μV
± 2 V	±0.02%rdg ±4digit	100 μV
± 20 V	±0.03%rdg ±5digit	1 mV
± 50 V	±0.05%rdg ±5digit	10 mV

積分時間:16.7/20ms

レンジ	確度	分解能
± 20 mV	±0.05%rdg ±10digit	2 μV
± 200 mV	±0.05%rdg ± 8digit	20 μV
± 2 V	±0.05%rdg ± 8digit	200 μV
± 20 V	±0.07%rdg ±10digit	2 mV
± 50 V	±0.07%rdg ±10digit	20 mV

発行番号:0303－5034	保管期間：3年	文書番号:FER03-0049	第2版	STD

機器形式： RD3500　　製造番号： 4030365

検査項目	定格及び検査項目（条件）	判定
④ 性能	・熱電対 積分時間:40/50/100ms	合格

ﾚﾝｼﾞ	測定範囲	確度	分解能
R·S	0～ 300℃	± 0.05% ±1.0℃	0.1℃
	300～1760℃	〃 ±0.7℃	
B	400～1100℃	± 0.05% ±1.2℃	0.1℃
	1100～1820℃	〃 ±0.7℃	
K	-200～-100℃	± 0.05% ±0.8℃	0.1℃
	-100～1370℃	〃 ±0.5℃	
E	-200～1000℃	± 0.05% ±0.6℃	0.1℃
J	-200～1200℃	± 0.05% ±0.6℃	0.1℃
T	-200～ 400℃	± 0.05% ±0.5℃	0.1℃
N	-100～1300℃	± 0.05% ±0.6℃	0.1℃
W	0～2320℃	± 0.05% ±1.1℃	0.1℃
PR	0～1600℃	± 0.05% ±1.0℃	1.0℃
Kp	0～ 300K	± 0.05% ±1.0K	0.1K

※W:WRe5-WRe26、Kp:KpAu7Fe

積分時間:16.7/20ms

ﾚﾝｼﾞ	測定範囲	確度	分解能
R·S	0～ 300℃	± 0.07% ±2.0℃	0.1℃
	300～1760℃	〃 ±1.5℃	
B	400～1100℃	± 0.07% ±3.0℃	0.1℃
	1100～1820℃	〃 ±2.0℃	
K	-200～-100℃	± 0.07% ±2.0℃	0.1℃
	-100～1370℃	〃 ±1.5℃	
E	-200～1000℃	± 0.07% ±1.5℃	0.1℃
J	-200～1200℃	± 0.07% ±2.0℃	0.1℃
T	-200～ 400℃	± 0.07% ±1.5℃	0.1℃
N	-100～1300℃	± 0.08% ±2.0℃	0.1℃
W	0～2320℃	± 0.1 % ±3.0℃	0.1℃
PR	0～1600℃	± 0.07% ±2.0℃	2.0℃
Kp	0～ 300K	± 0.07% ±2.0K	0.1K

・測温抵抗体 （導線形式:2·3導線、分解能:0.1℃）
積分時間:40/50/100ms

レンジ	測定範囲	確度
Pt100Ω	-200～ 650℃	± 0.1 rdg ±0.3℃
JPt100Ω	-200～ 500℃	

積分時間:16.7/20ms

レンジ	測定範囲	確度
Pt100Ω	-200～ 650℃	± 0.12rdg ±0.7℃
JPt100Ω	-200～ 500℃	

様式－２

機器形式：RD3500　　製造番号：4030365

検査項目	定格及び検査項目（条件）	判定
④ 性能	・ひずみ 積分時間:40/50/100ms レンジ：20000με / 200000με 測定範囲：±20000με / ±200000με 確度：±0.1 %F.S 分解能：1με / 10με 積分時間:16.7/20ms レンジ：20000με / 200000με 測定範囲：±20000με / ±200000με 確度：±0.15%F.S 分解能：2με / 20με	合格
⑤ パルス列動作	正常にｶｳﾝﾄ動作すること	合格
⑥ 内部基準接点補償動作	温度ｽｷｬﾅ端子台部の温度ｾﾝｻが室温を測定していること	合格
⑦ メモリ動作	ﾒﾓﾘｶｰﾄﾞﾃﾞｰﾀの書き込み及び読み込み動作確認	合格
⑧ ｽｷｬﾅﾕﾆｯﾄ（本体実装ﾕﾆｯﾄ）	温度・電圧ｽｷｬﾅﾕﾆｯﾄ(DE10-202)動作確認	合格
	NDISひずみｽｷｬﾅﾕﾆｯﾄ(DE10-203)動作確認	
	パルス列ｽｷｬﾅﾕﾆｯﾄ(DE10-204)動作確認	
	端子台ひずみｽｷｬﾅﾕﾆｯﾄ(DE10-205)動作確認	
	端子台ひずみｽｷｬﾅﾕﾆｯﾄ(DE10-206)動作確認	
	温度・電圧ｽｷｬﾅﾕﾆｯﾄH(DE10-207)動作確認	
	温度・電圧ｽｷｬﾅﾕﾆｯﾄV(DE10-208)動作確認	
	温度・電圧無接点ｽｷｬﾅﾕﾆｯﾄ(DE10-210)動作確認	
⑨ オプション	ｺﾐｭﾆｹｰｼｮﾝﾕﾆｯﾄ(RD35-106)動作確認	合格
	ｱﾗｰﾑ出力ﾕﾆｯﾄ(RD35-108)動作確認	
	ﾘﾓｰﾄｺﾝﾄﾛｰﾙﾕﾆｯﾄ(RD35-109)動作確認	
	内部照明(RD35-110)動作確認	合格

発行番号:0303－5034	保管期間：3年	文書番号:FER03-0049	第２版	STD

校 正 証 明 書

株式会社荏原エリオット　　殿

発行日：平成15年08月27日
日本電子応用機器株式会社
大阪Fセンター

試験日　　：平成１５年０８月２７日
証明書発行番号：０３０１－５１３３
製品形式番号　：ＲＤ３５００
製造番号　　：４０３-０３６５
製品名称　　：ハイブリッドレコーダ
成績書発行番号：０３０３－５０３４

上記製品は、当社の工業標準に基づき試験が行われ、試験結果は仕様を満たしています。

この試験にかかわる測定は、独立行政法人産業技術総合研究所等の公的研究所、またそれらの研究所によって認められている校正機関、また国際度量衡委員会に加盟している各国標準研究所または公的校正機関にトレーサビリティがとれています。

別紙に使用したワーク用測定器のトレーサビリティチャートを示します。

使用したワーク用測定器一覧

名　　称	形式	管理番号	有効期限
超絶縁計	SM-5E	FEW-06-005	平成１６年０１月
ﾃﾞｼﾞﾀﾙﾏﾙﾁﾒｰﾀ	R6581	FEW-03-002	平成１６年０１月
直流電圧発生器	R6161	FEW-14-010	平成１６年０１月
ﾌｧﾝｸｼｮﾝｼﾝｾｻｲｻﾞ	1930A	FEW-05-005	平成１５年１２月
ﾕﾆﾊﾞｰｻﾙｶｳﾝﾀ	TR5821	FEW-05-006	平成１５年１２月
ＣＡＬＢＯＸ	120Ω	FEW-18-010	平成１６年０１月
0℃基準器	ZC-114	FEW-07-015	平成１６年０１月
熱電対Ｔ型	T35	FEW-07-018	平成１７年０１月
6ﾀﾞｲｱﾙ可変抵抗	2793-01	FEW-16-004	平成１６年０１月
ﾀﾞｲｱﾙ型可変抵抗	2786	FEW-16-008	平成１６年０１月

検査成績書

TEST REPORT

Ship No. －－－－－－

TAG No. －－－－－－

器物番号 0052442

Serial No

流量計仕様 Flow Meter Specification

口 径 Size	50mm	受信器 Electric-instrument 変換器 Converter	－－－－－－ －－－－－－ －－－－－－
型 式 Model	RQE1050B0FF233450010R		
液体名 Fluid	タービン油		
	80 ℃	ｱﾅﾛｸﾞ信号 Analog signal	ﾌﾙｽｹｰﾙ Full Scale 4～20mA 0～15m³/h －－－－－－
流量範囲 Flow Range	0.7～15m³/h	パルス信号 Pulse signal	流量計発信パルス単位 Transmitter output unit 1L/P
			変換器出力パルス単位 Converter output unit －－－－－－

試験成績 (Test Data)

mf＝74.50 mL/P

器差 Accuracy Within (±0.5%)	流量m³/h Flow Rate	0.7	12	15	－－－－ －－	－－－－ －－	合格 Acceptable
	器差 (%) Accuracy	0.00	+0.21	+0.20	－－－－ －－	－－－－ －－	
	－－－－－－						
指示差、出力試験 Indicate Test	ﾌﾙｽｹｰﾙの－－－－－－－ Full scale Within						合格 Acceptable
	0～15 m³/h (4～20mA) (－－－－－－－)						
パルス試験 Pulse Test	流量計発信ﾊﾟﾙｽ単位 1L/P Transmitter output unit		変換器ﾊﾟﾙｽ出力単位 －－－－－－－ Converter output unit				合格 Acceptable
耐圧試験 Pressure Proof Test	水圧 －－－－－－－ －－－－－－－ Water Proof Pressure						
ストレーナー Strainer	型式 (－－－－－－－) Strainer		耐圧試験 (－－－－－－－ －－－－－－－) Pressure proof Test				
その他 Remarks	－－－－－－－						

試験日 Test Date H14/10/22	検査 Inspector 大槻	承認 Approved 矢野	日東精工株式会社 NITTO SEIKO CO., LTD.
成績 (　) 部 取説 (　) 部			工事番号 M59371 Job No.

校正証明書

品名	:	
型式	:	RQE1050B0FF233450010R
器物番号	:	0052442
工事番号	:	M59371
校正年月日	:	H14/10/22

※校正機器

校正機器名	:	液体メーター用基準タンク
型式または能力	:	全量 300L
器物番号	:	441
有効期限	:	平成１２年１１月１４日 ～平成１７年１１月１３日まで

本流量計は、ＪＩＳ Ｂ ７５５２(液体用流量計器差試験方法)で規定されたタンクによる方法によって、校正したことを証明します。

H14/10/22

校正会社名　：日東精工株式会社
制御システム事業部

所　在　地　：京都府綾部市延町野上畑３０番地

計器検定成績書

INSTRUMENT TEST CERTIFICATE

管理番号: NO-(1)-005 (Manage No.)　　計器番号: 66347892 (Mfg. No.)

型　式: NA-20 (Type)　　測定範囲: 31.5～8000 Hz (Range)

最大許容差 (Tolerance of Accuracy): ± 1.5 dB

基準器 (Standard Instrument)

型　式 (Type):	NC-72
名　称 (Description):	PISTON PHONE
計器番号 (Mfg. No.):	00330925
管理番号 (Manage No.):	

試験状態 (Test Conditions): 良

室　温 (Ambient Temp.): 20°C　　大気圧 (Barometer):

試験結果 (Test Results)

基準入力 Standard Input	250Hz / 114.0dB				
計器の読み(dB) Instrument Reading	114.0				
誤　差(dB) Errors	0				
判　定 Acceptability	合　格 ACCEPTABLE				

備　考 (Note): 騒音計

承認者 (App'd by):

試験者 (Tested by): 阿津

試験日 (Date): '03. 1. 10

TITLE	Mechanical Running Test Report	DOC.No. 8214-IT061	REV. 0
CUSTOMER	LG Engineering & Construction Corp.	COMPLETE IN WITH COVER	106 SHEETS
FINAL USER	Turkish Petroleum Refineries Corp.		
PROJECT	Tupras Izmir Refinery DHP Project	SERVICE	Recycle Compressor
JOB No.	7020	EBARA SER.No.	R021570803
			R021570802
ITEM No.	TC-9901	MODEL/EQUIP.	SRV-5DF SET 1
	CT-9901		25MB5 SET 1
			SET

Note : This report is for A (Spare) Rotor.

LG E&C INSPECTION TEAM ☑ WITNESSED ☐ REVIEWED

☐ FOR APPROVAL AVOID DELAY TO MAINTAIN SHIPPING PROMISE. ONE APPROVED PRINT MUST BE RETURNED BY: _____ BY: _____ DATE: _____	☐ ANY REQUESTED CHANGE OF THIS EQUIPMENT WILL RESULT IN: 1.CONTRACT PRICE ADJUSTMENT 2.EXTENDED SHIPPING PROMISE AS THIS CONTRACT IS IN MANUFACTURING PROCESS. BY: _____ DATE: _____

TO SET
CUS. 1R

Issued by
Test Engineering Section

APPROVED BY H. Ishikawa Oct 3 '03

CHECKED BY

PREPARED BY N. Ishikawa

REV.	PAGE	DATE	APP'D	BY
5				
4				
3				
2				
1				

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

CONTENTS

1.1 SUMMARY OF TEST RESULT (COMPRESSOR)

SO No. : R021570802 Item No : CT-9901

Model : 25MB5 Rotor : A (Spare)

Item	Acceptance Criteria			Test Result		
Shaft Vibration	25.0 μm p-p @ MCS			MAX.	9.8	μm p-p
	150% of recorded value @MCS @ OVS			MAX.	10.0	μm p-p
Vibration Sweep	Non Synchro. Freq. Vib.	5.0	μm p-p	MAX.	4.117	μm p-p
Critical Speed	.				4699.	rpm
Amprification Factor	Formula : AF=Nc1/(N2-N1)			AF=	7.63	
	AF<2.5 : No Separation Margin Required.			.	NC1=	4699.
	2.5≦AF<3.55 : 5% Blow Minimum Speed			.	N1=	4382.
	3.5≦AF : SM≧100-(84+6/(AF-3)) [%]			<——	N2=	4998.
Separation Margin	(Nmin - Nc1) / Nmin =			Actual	34.9%	
				Specified	14.7%	
	(Nmin = 7218.)			Acceptable		
Lube Oil Drain Temp.	@MCS ΔT≦ 28 ℃			Max.	25.5	℃
Lube Oil Supply Flow	(Test Condition Target Value : @MCS	178.	lit/min.)	Max.	177.	lit/min.
.	.					
.				.		
Bearing Metal Temp.	@MCS ≦127℃			Max.	97.5	℃
Primary Seal Gas Leak.	'@MCS (See H8 of Test Proc.) 1st measurement				0.29	Lit./Min./ Machine
	. . 2nd measurement				0.34	
Bearing Performance	Stable Rotor - Bearing System				Good	
Outward Oil Leakage	No Leakage				No Leakage	
Sound Level	Reference only (around 25MB5)			Max.	82	dBA

Test result **Acceptable**

INSPECTION TEAM
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LG E&C

Test Date 03-Oct-03 Test Engineer N. Ishikawa

1.2 SUMMARY OF TEST RESULT (TURBINE)

SO No. : R021570803 Item No : TC-9901

Model : SRV-5DF Rotor : A (Spare)

Item	Acceptance Criteria	Test Result		
Shaft Vibration	25.0 μm p-p @ MCS	MAX.	10.4	μm p-p
	150% of recorded value @MCS @ OVS	MAX.	13.6	μm p-p
Vibration Sweep	Non Synchro. Freq. Vib. 5.0 μm p-p	MAX.	1.924	μm p-p
Critical Speed			3996.	rpm
Amprification Factor	Formula : AF=Nc1/(N2-N1)	AF=	7.01	
	AF<2.5 : No Separation Margin Required.	.	NC1=	3996.
	2.5≦AF<3.55 : 5% Blow Minimum Speed	.	N1=	3640.
	3.5≦AF : SM≧100-(84+6/(AF-3)) [%]	<——	N2=	4210.
Separation Margin	(Nmin - Nc1) / Nmin =	Actual	44.6%	
		Specified	14.5%	
	(Nmin = 7218.)	Acceptable		
Lube Oil Drain Temp.	@MCS ΔT≦ 28 ℃	Max.	25.4	℃
Lube Oil Supply Flow	(Test Condition Target Value : 178. lit/min.) @MCS	Max.	177.	lit/min.
Bearing Metal Temp.	@MCS ≦127℃	Max.	98.8	℃
Remote Trip Test	-		Good	
Overspeed Trip Test	11792 - 12030 rpm (elec.)	1st	11910.	rpm
		2nd	-	rpm
		3rd	-	rpm
Speed Control	7218 - 10828 rpm		Good	
Steam Tightness	No Leakage		No Leakage	
Manual Excercise	Smooth Operation		Good	
Bearing Performance	Stable Rotor - Bearing System		Good	
Outward Oil Leakage	No Leakage		No Leakage	
Sound Level	Reference only (around SRV-5DF)	Max.	82	dBA
Turning Motor Operation	Smooth Operation		Good	

Test result Acceptable

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LG E&C

Test Date 03-Oct-03 Test Engineer N. Ishikawa

2 Record for Compressor

2-1 Running Test Record

Period		
9:58	to 18:51	Normal Mechanical Running Test
11:38	to 11:53	Over Speed Running
12:00	to 16:00	4hours Running at MCS
		*Bearing Performance Test
13:24	to 13:39	Lube Oil Supply Temp. = 43 ℃
		Lube Oil Supply Press. = 1.27kg/cm2G
14:06	to 14:21	Lube Oil Supply Temp. = 49 ℃
		Lube Oil Supply Press. = 1.05kg/cm2G
17:15	to 18:51	Unbalance Verification Test

コンプレッサ運転記録

COMPRESSOR RUNNING TEST RECORD (1/3)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

回転方向（駆動側から見て） DIRECTION OF ROTATION (facing drive end) : 時計 CW

ロータ ROTOR : A A

起動 START 9:58 停止 STOP 18:51

時刻 TIME	回転数 SPEED min⁻¹	軸振動 SHAFT VIBRATION (μm p-p) 駆動側 DRIVE END CH. NO 16	駆動側 CH. NO 15	反駆動側 OP DRIVE END CH. NO 18	反駆動側 CH. NO 17	軸移動量1 AXIAL DISP.1 mm	軸移動量2 AXIAL DISP.2 mm	吸込圧力 INLET PRESS kgf/cm²G	吐出圧力 DISCH. PRESS kgf/cm²G	平衡室圧力 BALANCE CHAM. PRESS kgf/cm²G	バッファガス圧力 BUFFER GAS PRESS kgf/cm²G	バッファガス差圧 BUFFER DIFF. PRESS kgf/cm²D	
9:58	0	------	------	------	------	-0.13	-0.12	-1.00	-1.00	-0.99	0.63	1.62	
10:05	19	------	------	------	------	-0.13	-0.12	-1.00	-1.00	-0.99	0.72	1.70	
10:24	1093	8.9	8.0	3.2	2.7	-0.08	-0.07	-1.00	-1.00	-0.99	0.49	1.48	
10:42	2996	9.2	8.9	3.6	3.5	-0.04	-0.05	-1.02	-1.02	-1.00	0.49	1.49	
10:57	7212	8.7	8.6	3.3	3.2	-0.04	-0.05	-1.02	-1.01	-1.00	0.45	1.45	
11:07	10833	9.1	9.4	3.2	3.2	-0.09	-0.08	-1.02	-1.01	-1.00	0.44	1.43	
11:16	7217	8.9	8.9	3.4	3.3	-0.05	-0.04	-1.00	-1.01	-0.99	0.48	1.47	
11:20	8121	9.0	9.0	3.2	3.2	-0.05	-0.04	-0.99	-1.01	-0.99	0.51	1.50	
11:23	9021	8.7	9.2	3.0	3.1	-0.05	-0.05	-0.99	-1.01	-0.99	0.52	1.52	
11:27	9925	9.0	9.2	3.2	3.1	-0.05	-0.05	-0.99	-1.01	-0.99	0.51	1.51	
11:29	10828	9.1	9.4	3.3	3.3	-0.06	-0.07	-0.99	-1.00	-0.99	0.50	1.49	
11:38	11791	9.4	9.9	3.4	3.7	-0.08	-0.08	-0.98	-1.00	-0.99	0.46	1.46	
11:53	11793	9.5	10.0	3.5	3.8	-0.08	-0.07	-0.98	-1.00	-0.99	0.43	1.42	
12:00	10826	9.3	9.6	3.5	3.7	-0.08	-0.05	-0.97	-1.00	-0.99	0.51	1.50	
12:15	10828	9.3	9.6	3.5	3.8	-0.07	-0.05	-0.97	-1.00	-0.99	0.54	1.53	
12:30	10825	9.3	9.6	3.6	3.8	-0.05	-0.04	-0.97	-1.00	-0.99	0.55	1.54	
12:45	10828	9.3	9.6	3.6	3.9	-0.06	-0.04	-0.97	-0.98	-0.99	0.55	1.54	

一次危険速度 FIRST CRITICAL SPEED	4699	min⁻¹

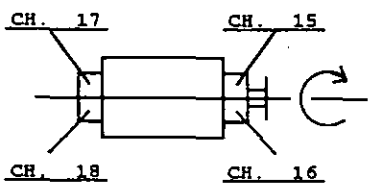
外部油漏れ OUTWARD OIL LEAKAGE	合格 NO LEAK

プライマリシール漏れ量 PRIMARY SEAL LEAKAGE (Lit/min)	時刻 TIME	13: 0	15: 5	
	駆動側 DRIVE END	0.10	0.14	
	反駆動側 OP DRIVE END	0.19	0.20	

Lube Oil Flow
① 13:00 173 Lit/min
② 15:00 177 Lit/min

[記事 NOTES]

1. 油 OIL : ISO VG#32
2. コンプレッサ軸中心と油圧力計との高さの差
   Differential head between the compressor centerline and the oil pressure gauge = 0.00 m, 0.00 kgf/cm²G
3. 軸振動計器番号 上から見て
   Vibration channel No. ---- plan view.



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審査 TEST ENGINEER 日付 DATE

N.ISHIKAWA 03/10/01

記録 RECORDED BY 日付 DATE

T.NISHIYAMA 03/10/01

コンプレッサ運転記録

COMPRESSOR RUNNING TEST RECORD (1/3)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

回転方向（駆動側から見て） DIRECTION OF ROTATION (facing drive end) : 時計 CW

ロータ ROTOR : A

起動 START 9:58 停止 STOP 18:51

時刻 TIME	回転数 SPEED min⁻¹	軸振動 SHAFT VIBRATION (μm p-p) 駆動側 DRIVE END CH. NO 16	駆動側 DRIVE END CH. NO 15	反駆動側 OP.DRIVE END CH. NO 18	反駆動側 OP.DRIVE END CH. NO 17	軸移動量1 AXIAL DISP.1 mm	軸移動量2 AXIAL DISP.2 mm	吸込圧力 INLET PRESS kgf/cm²G	吐出圧力 DISCH. PRESS kgf/cm²G	平衡室圧力 BALANCE CHAM. PRESS kgf/cm²G	バッファガス圧力 BUFFER GAS PRESS kgf/cm²G	バッファガス差圧 BUFFER DIFF. PRESS kgf/cm²D
13:00	10827	9.3	9.6	3.8	4.1	-0.04	-0.03	-0.96	-0.97	-0.99	0.45	1.44
13:15	10827	9.2	9.5	3.6	3.7	-0.06	-0.05	-0.96	-0.96	-0.99	0.52	1.51
13:24	10825	9.2	9.5	3.7	3.9	-0.05	-0.03	-0.96	-0.96	-0.99	0.54	1.53
13:30	10825	9.2	9.5	3.7	3.9	-0.04	-0.04	-0.96	-0.96	-0.99	0.53	1.52
13:39	10828	9.2	9.5	3.7	3.9	-0.05	-0.03	-0.96	-0.95	-0.99	0.52	1.51
13:45	10827	9.3	9.5	3.9	4.2	-0.03	-0.04	-0.96	-0.95	-0.99	0.52	1.51
14:00	10825	9.4	9.7	4.3	4.8	-0.06	-0.03	-0.96	-0.94	-0.98	0.53	1.51
14:06	10828	9.4	9.8	4.4	5.0	-0.04	-0.03	-0.96	-0.94	-0.98	0.54	1.52
14:15	10824	9.4	9.8	4.5	5.1	-0.04	-0.04	-0.96	-0.94	-0.98	0.57	1.55
14:21	10827	9.4	9.8	4.5	5.1	-0.06	-0.04	-0.96	-0.93	-0.98	0.53	1.51
14:30	10826	9.4	9.7	4.1	4.6	-0.06	-0.04	-0.95	-0.93	-0.97	0.74	1.71
14:45	10829	9.3	9.7	4.1	4.5	-0.06	-0.03	-0.96	-0.93	-0.98	0.38	1.35
15:00	10829	9.3	9.6	4.1	4.5	-0.03	-0.04	-0.95	-0.93	-0.97	0.51	1.48
15:15	10827	9.4	9.6	4.1	4.6	-0.05	-0.04	-0.95	-0.93	-0.97	0.55	1.52
15:30	10826	9.4	9.6	4.1	4.5	-0.04	-0.03	-0.95	-0.93	-0.97	0.49	1.46
15:45	10826	9.3	9.7	4.1	4.6	-0.03	-0.04	-0.95	-0.93	-0.97	0.48	1.45
16:00	10825	9.3	9.6	4.1	4.6	-0.07	-0.04	-0.95	-0.93	-0.96	0.50	1.46
16:06	9925	9.2	9.5	4.0	4.3	-0.06	-0.03	-0.95	-0.93	-0.96	0.49	1.46
16:08	9027	9.1	9.3	3.7	4.0	-0.03	-0.03	-0.95	-0.93	-0.96	0.49	1.45
16:11	8118	9.1	9.3	3.6	3.9	-0.03	-0.02	-0.95	-0.93	-0.96	0.48	1.45
16:15	7219	9.0	9.1	3.8	4.0	-0.03	-0.01	-0.95	-0.93	-0.96	0.49	1.45
16:25	0	------	------	------	------	-0.06	-0.06	-0.95	-0.93	-0.96	0.51	1.47
17:15	0	------	------	------	------	-0.11	-0.11	-0.95	-0.93	-0.96	0.49	1.45

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記録 RECORDED BY 日付 DATE

T.NISHIYAMA 03/10/01

コンプレッサ運転記録

8

COMPRESSOR RUNNING TEST RECORD (1/3)

PAGE : 3

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

回転方向（駆動側から見て） DIRECTION OF ROTATION (facing drive end) : 時計 CW

ロータ ROTOR : A A

起動 START 9:58 停止 STOP 18:51

時刻 TIME	回転数 SPEED min⁻¹	軸振動 SHAFT VIBRATION (μm p-p) 駆動側 DRIVE END CH. NO 16	駆動側 CH. NO 15	反駆動側 OP.DRIVE END CH. NO 18	反駆動側 CH. NO 17	軸移動量1 AXIAL DISP.1 mm	軸移動量2 AXIAL DISP.2 mm	吸込圧力 INLET PRESS kgf/cm²G	吐出圧力 DISCH. PRESS kgf/cm²G	平衡室圧力 BALANCE CHAM. PRESS kgf/cm²G	バッファガス圧力 BUFFER GAS PRESS kgf/cm²G	バッファガス差圧 BUFFER DIFF. PRESS kgf/cm²D	
17:30	1230	8.8	7.9	3.4	2.8	-0.06	-0.05	-0.95	-0.93	-0.96	0.49	1.45	
17:44	2380	9.0	8.4	3.9	3.4	-0.03	-0.03	-0.95	-0.93	-0.96	0.49	1.45	
17:52	7217	9.6	9.6	3.6	3.6	-0.05	-0.03	-0.95	-0.92	-0.96	0.49	1.45	
18:04	10824	10.6	11.3	3.8	4.2	-0.07	-0.05	-0.95	-0.92	-0.96	0.49	1.44	
18:21	11778	11.7	12.1	4.2	4.7	-0.08	-0.07	-0.95	-0.92	-0.95	0.49	1.44	
18:33	10825	11.0	11.4	3.9	4.3	-0.05	-0.05	-0.95	-0.92	-0.95	0.49	1.45	
18:42	7120	10.0	9.9	3.7	3.8	-0.03	-0.03	-0.95	-0.92	-0.95	0.49	1.45	
18:51	0	------	------	------	------	-0.09	-0.08	-0.95	-0.92	-0.95	0.50	1.46	

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T.NISHIYAMA 03/10/01

コンプレッサ運転記録

9

COMPRESSOR RUNNING TEST RECORD (2/3)

PAGE : 1

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

回転方向（駆動側から見て） DIRECTION OF ROTATION (facing drive end) : 時計 CW　　ロータ ROTOR : A　　起動 START 9:58　　停止 STOP 18:51

時刻 TIME	回転数 SPEED min⁻¹	軸受給油圧 LUBE OIL PRESS. kgf/cm²G	軸受給油温度 LUBE OIL INLET TEMP. ℃	軸受戻り油温度 駆動側 LUBE DRAIN TEMP. (DE) ℃	軸受戻り油温度 反駆動側 LUBE DRAIN TEMP. (OP.DE) ℃	軸受戻り油温度スラスト LUBE DRAIN TEMP. (THRUST) ℃							
9:58	0	1.18	45.0	42.9	44.9	45.1							
10:05	19	1.17	45.1	42.9	45.1	45.2							
10:24	1093	1.17	45.3	43.1	45.7	45.7							
10:42	2996	1.13	45.3	45.1	47.9	47.1							
10:57	7212	1.12	45.2	56.2	56.6	52.8							
11:07	10833	1.11	45.5	66.9	64.7	60.1							
11:16	7217	1.11	45.5	58.5	57.2	53.1							
11:20	8121	1.12	45.4	60.5	58.9	54.5							
11:23	9021	1.12	45.4	62.9	60.6	56.2							
11:27	9925	1.12	45.4	65.3	63.1	58.0							
11:29	10828	1.13	45.3	67.8	64.4	59.7							
11:38	11791	1.12	45.6	72.3	67.4	61.9							
11:53	11793	1.12	45.4	74.0	67.7	61.8							
12:00	10826	1.12	45.5	71.0	65.2	59.8							
12:15	10828	1.11	45.4	70.6	65.1	59.8							
12:30	10825	1.12	45.2	70.5	65.0	59.6							
12:45	10828	1.12	45.2	70.5	65.0	59.6							

LG E&C　INSPECTION TEAM ☑ WITNESSED ☐ REVIEWED

御立会者 WITNESSED BY　　日付 DATE

/ /

審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA　N. Ishikawa　03/10/01

記録 RECORDED BY　　日付 DATE

T.NISHIYAMA　T. Nishiyama　03/10/01

コンプレッサ運転記録

10

COMPRESSOR RUNNING TEST RECORD (2/3)

PAGE : 2

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

回転方向（駆動側から見て） DIRECTION OF ROTATION (facing drive end) : 時計 CW　　ロータ ROTOR : A A　　起動 START 9:58　　停止 STOP 18:51

時刻 TIME	回転数 SPEED min⁻¹	軸受給油圧 LUBE OIL PRESS. kgf/cm²G	軸受給油温度 LUBE OIL INLET TEMP. ℃	軸受戻り油温度 駆動側 LUBE DRAIN TEMP. (DE) ℃	軸受戻り油温度 反駆動側 LUBE DRAIN TEMP. (OP.DE) ℃	軸受戻り油温度スラスト LUBE DRAIN TEMP. (THRUST) ℃							
13:00	10827	1.12	45.5	70.7	65.2	59.9							
13:15	10827	1.29	42.3	67.8	62.8	56.9							
13:24	10825	1.27	42.9	68.0	63.0	57.4							
13:30	10825	1.26	42.7	67.8	62.8	57.2							
13:39	10828	1.28	42.5	67.7	62.7	57.1							
13:45	10827	1.18	45.7	69.4	64.1	59.5							
14:00	10825	1.06	48.7	73.0	67.5	62.4							
14:06	10828	1.07	49.1	73.4	67.9	62.6							
14:15	10824	1.06	49.7	73.9	68.3	63.1							
14:21	10827	1.06	49.7	73.9	68.3	63.1							
14:30	10826	1.19	45.7	70.8	65.1	59.8							
14:45	10829	1.17	45.7	70.7	65.1	59.8							
15:00	10829	1.17	45.6	70.5	65.0	59.8							
15:15	10827	1.18	45.5	70.5	65.0	59.6							
15:30	10826	1.18	45.7	70.6	65.1	59.8							
15:45	10826	1.17	45.6	70.6	65.0	59.7							
16:00	10825	1.17	45.5	70.6	65.1	59.7							
16:06	9925	1.17	45.6	67.8	63.6	58.0							
16:08	9027	1.17	45.6	65.7	62.1	56.4							
16:11	8118	1.17	45.6	63.1	59.8	54.7							
16:15	7219	1.18	45.6	60.4	57.4	53.2							
16:25	0	1.22	45.7	48.0	46.3	45.8							
17:15	0	1.22	45.6	45.5	45.8	45.6							

INSPECTION TEAM
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N.ISHIKAWA　　03/10/01

記録 RECORDED BY　　日付 DATE

T.NISHIYAMA　　03/10/01

コンプレッサ運転記録

11

COMPRESSOR RUNNING TEST RECORD (2/3)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

回転方向（駆動側から見て） DIRECTION OF ROTATION (facing drive end) : 時計 CW　　ロータ ROTOR : A A　　起動 START 9:58　　停止 STOP 18:51

時刻 TIME	回転数 SPEED min⁻¹	軸受給油圧 LUBE OIL PRESS. kgf/cm²G	軸受給油温度 LUBE OIL INLET TEMP. ℃	軸受戻り油温度 駆動側 LUBE DRAIN TEMP. (DE) ℃	軸受戻り油温度 反駆動側 LUBE DRAIN TEMP. (OP.DE) ℃	軸受戻り油温度スラスト LUBE DRAIN TEMP. (THRUST) ℃							
17:30	1230	1.24	45.6	45.8	46.4	46.0							
17:44	2380	1.22	45.6	46.9	47.7	46.8							
17:52	7217	1.17	45.6	56.6	56.5	53.0							
18:04	10824	1.16	45.6	67.0	64.6	59.7							
18:21	11778	1.17	45.7	73.1	67.4	61.8							
18:33	10825	1.17	45.6	70.1	65.0	59.7							
18:42	7120	1.18	45.7	59.9	57.0	53.1							
18:51	0	1.22	45.7	48.0	46.2	45.7							

INSPECTION TEAM
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コンプレッサ運転記録

COMPRESSOR RUNNING TEST RECORD (3/3)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

回転方向（駆動側から見て） DIRECTION OF ROTATION (facing drive end) : 時計 CW　　ロータ ROTOR : A　　起動 START 9:58　　停止 STOP 18:51

時刻 TIME	回転数 SPEED min⁻¹	ジャーナル軸受温度 駆動側 JNL.BRG TEMP. (DE) ℃	ジャーナル軸受温度 駆動側 JNL.BRG TEMP. (DE) ℃	ジャーナル軸受温度 反駆動側 JNL.BRG TEMP. (OP DE) ℃	ジャーナル軸受温度 反駆動側 JNL.BRG TEMP. (OP DE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 反負荷側 THRUST. BRG TEMP. (INACTIVE) ℃	スラスト軸受温度 反負荷側 THRUST. BRG TEMP. (INACTIVE) ℃			
9:58	0	43.2	43.4	45.0	45.0	45.6	45.6	45.5	45.4	45.4			
10:05	19	43.4	43.5	45.1	45.2	45.9	46.1	45.6	45.5	45.5			
10:24	1093	48.4	48.5	49.1	49.4	47.8	48.6	46.3	47.9	48.8			
10:42	2996	59.4	57.7	59.1	58.0	48.3	49.9	47.6	49.0	52.3			
10:57	7212	82.7	77.7	77.4	76.3	51.4	51.8	52.2	52.2	54.2			
11:07	10833	98.3	91.2	88.6	89.1	55.0	55.9	57.5	60.6	61.0			
11:16	7217	83.0	76.4	77.3	76.7	52.1	52.3	52.6	52.4	53.7			
11:20	8121	87.3	80.2	80.2	79.7	52.6	53.0	53.8	53.8	54.7			
11:23	9021	91.2	84.0	83.1	82.8	53.1	53.9	55.1	55.4	56.1			
11:27	9925	94.9	88.3	86.5	86.8	54.0	54.8	56.1	57.4	57.9			
11:29	10828	98.0	91.2	89.1	89.3	54.8	55.9	57.3	59.6	60.3			
11:38	11791	100.6	92.4	90.9	92.6	56.7	57.6	59.6	62.0	63.0			
11:53	11793	100.2	91.5	90.6	92.5	56.7	57.7	59.5	60.6	62.3			
12:00	10826	96.9	89.0	88.6	88.8	55.4	56.5	58.2	58.3	59.6			
12:15	10828	97.5	89.2	88.7	88.8	55.6	56.6	58.3	58.1	59.4			
12:30	10825	97.4	89.1	88.6	88.6	55.4	56.5	58.3	57.7	59.1			
12:45	10828	97.4	89.0	88.7	88.7	55.5	56.7	58.3	57.7	59.1			

INSPECTION TEAM
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T.NISHIYAMA　　03/10/01

コンプレッサ運転記録

13

COMPRESSOR RUNNING TEST RECORD (3/3)

PAGE : 2

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

回転方向（駆動側から見て） DIRECTION OF ROTATION (facing drive end) : 時計 CW	ロータ ROTOR : A	起動 START 9:58	停止 STOP 18:51

時刻 TIME	回転数 SPEED min⁻¹	ジャーナル軸受温度 駆動側 JNL.BRG TEMP. (DE) ℃	ジャーナル軸受温度 駆動側 JNL.BRG TEMP. (DE) ℃	ジャーナル軸受温度 反駆動側 JNL.BRG TEMP. (OP DE) ℃	ジャーナル軸受温度 反駆動側 JNL.BRG TEMP. (OP DE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 反負荷側 THRUST. BRG TEMP. (INACTIVE) ℃	スラスト軸受温度 反負荷側 THRUST. BRG TEMP. (INACTIVE) ℃			
13:00	10827	97.3	89.0	88.6	88.7	55.7	56.7	58.4	57.7	59.2			
13:15	10827	97.5	87.8	86.7	88.6	52.7	54.1	55.8	54.5	55.4			
13:24	10825	97.3	88.6	87.0	88.7	53.3	54.7	56.3	55.0	56.1			
13:30	10825	97.2	88.5	87.0	88.6	53.1	54.5	56.3	54.7	55.8			
13:39	10828	97.4	88.3	87.0	88.4	53.1	54.4	56.2	54.7	55.6			
13:45	10827	97.5	89.1	89.5	88.8	55.8	56.9	58.5	57.4	58.4			
14:00	10825	97.0	89.8	89.6	90.4	58.9	59.8	61.3	60.1	61.7			
14:06	10828	97.0	89.9	89.8	90.1	59.2	60.0	61.5	60.5	62.1			
14:15	10824	96.9	89.9	89.9	90.2	59.6	60.5	61.9	60.9	62.6			
14:21	10827	96.9	89.8	89.8	90.2	59.6	60.4	61.8	61.2	62.4			
14:30	10826	96.7	88.3	88.4	87.9	56.0	57.0	58.5	57.4	58.7			
14:45	10829	96.9	88.4	88.4	88.0	55.9	57.0	58.6	57.2	58.6			
15:00	10829	96.9	88.5	88.5	88.1	55.9	57.0	58.5	57.3	58.5			
15:15	10827	96.8	88.5	88.4	87.8	55.8	56.9	58.3	57.2	58.5			
15:30	10826	96.9	88.6	88.6	88.1	55.9	57.0	58.6	57.5	58.7			
15:45	10826	96.9	88.6	88.6	87.9	55.9	57.0	58.6	57.3	58.7			
16:00	10825	96.8	88.4	88.4	87.9	55.8	57.0	58.4	57.3	58.5			
16:06	9925	94.3	85.2	85.3	85.8	54.6	56.0	57.2	55.9	56.6			
16:08	9027	91.6	82.6	83.4	83.4	54.0	54.9	55.9	54.4	54.8			
16:11	8118	87.7	79.3	80.5	80.2	53.4	53.9	54.7	52.7	53.6			
16:15	7219	83.1	76.1	77.3	76.6	52.8	52.9	53.0	51.8	52.8			
16:25	0	50.8	50.4	48.5	49.3	46.3	46.4	46.2	46.1	46.3			
17:15	0	46.0	46.0	46.2	46.5	46.1	46.2	45.8	45.8	45.8			

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INSPECTION TEAM
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T.NISHIYAMA 03/10/01

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

コンプレッサ運転記録

14

COMPRESSOR RUNNING TEST RECORD (3/3)

PAGE : 3

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	CT-9901	R0215708	25MB5

回転方向（駆動側から見て） DIRECTION OF ROTATION (facing drive end) : 時計 CW　　ロータ ROTOR : A　　起動 START 9:58　　停止 STOP 18:51

時刻 TIME	回転数 SPEED min⁻¹	ジャーナル軸受温度 駆動側 JNL.BRG TEMP. (DE) ℃	ジャーナル軸受温度 駆動側 JNL.BRG TEMP. (DE) ℃	ジャーナル軸受温度 反駆動側 JNL.BRG TEMP. (OP DE) ℃	ジャーナル軸受温度 反駆動側 JNL.BRG TEMP. (OP DE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 反負荷側 THRUST. BRG TEMP. (INACTIVE) ℃	スラスト軸受温度 反負荷側 THRUST. BRG TEMP. (INACTIVE) ℃			
17:30	1230	50.5	50.2	50.6	51.0	47.9	47.1	46.7	47.5	49.1			
17:44	2380	57.0	55.7	56.7	56.2	48.7	48.3	47.4	48.0	50.8			
17:52	7217	81.1	76.7	77.2	75.6	51.9	52.1	52.6	51.9	53.6			
18:04	10824	96.0	89.8	88.2	87.3	54.9	56.0	57.2	58.8	59.6			
18:21	11778	98.7	91.3	90.4	91.4	56.7	57.8	59.4	60.1	61.5			
18:33	10825	95.8	88.4	88.4	87.5	55.4	56.4	58.0	57.7	59.0			
18:42	7120	81.8	75.9	77.3	76.2	52.7	52.7	52.8	51.6	52.9			
18:51	0	50.4	50.1	48.3	49.1	46.3	46.4	46.0	46.0	46.1			

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T.NISHIYAMA　　03/10/01

2 Record for Compressor

2-2 Vibration Amplitude Record

a Bode Plot of Start up

[Note]

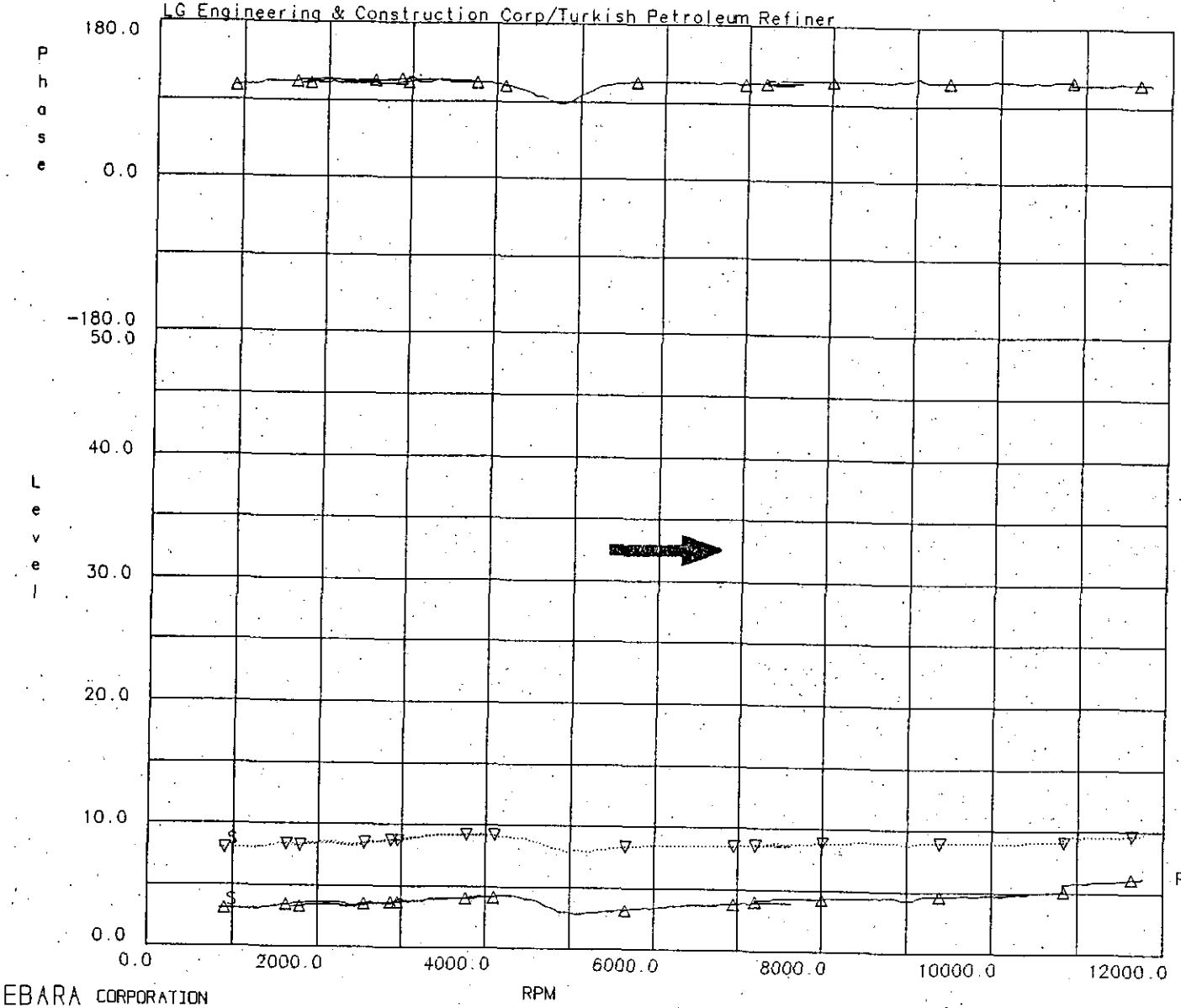
C.CP.X	:	Drive End X
C.CP.Y	:	Drive End Y
C.OCP.X	:	Non Drive End X
C.OCP.Y	:	Non Drive End Y

EO : 1.0	:	Synchronous Frequency
TOTAL	:	Overall
Unit	:	Vibration : μ m p-p
		Phase : Degree

R0215708
25MB5

SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
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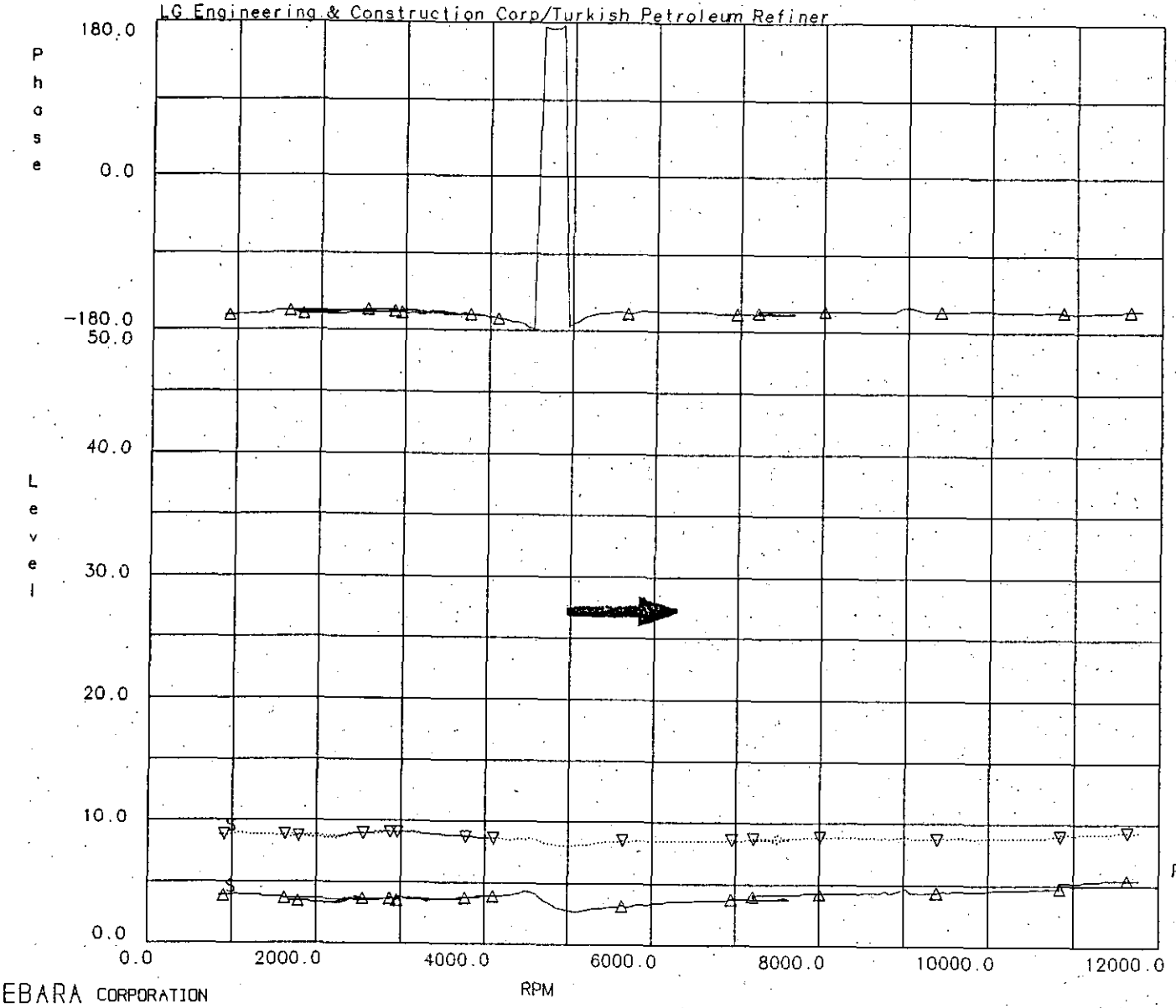
EBARA CORPORATION

Wed Oct 1 10:05:49 2003

R0215708
25MB5

SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



PK to PK

INSPECTION TEAM
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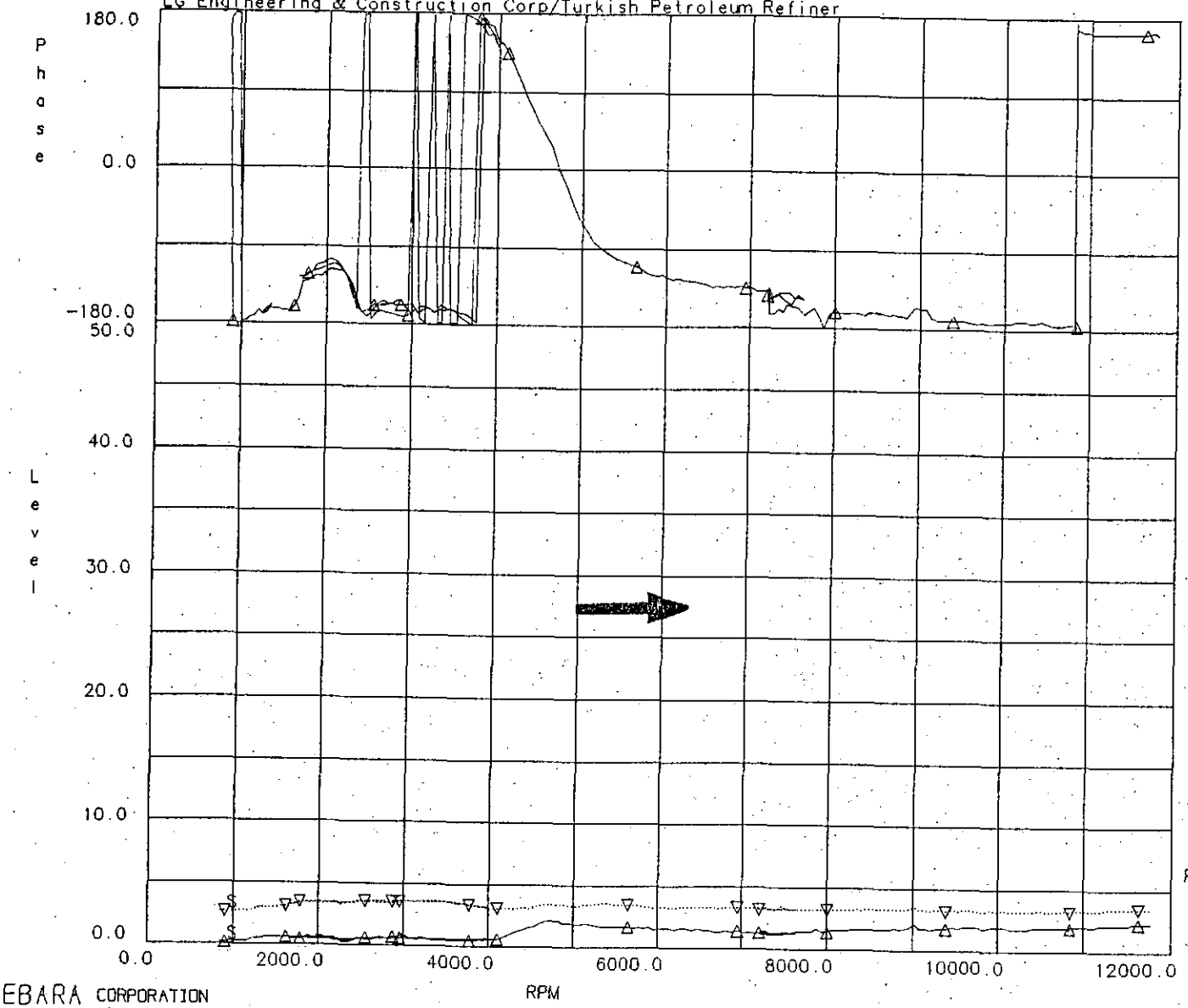
SRV-5DF
LG Engineering & Construction Corp/Turkish Petroleum Refiner



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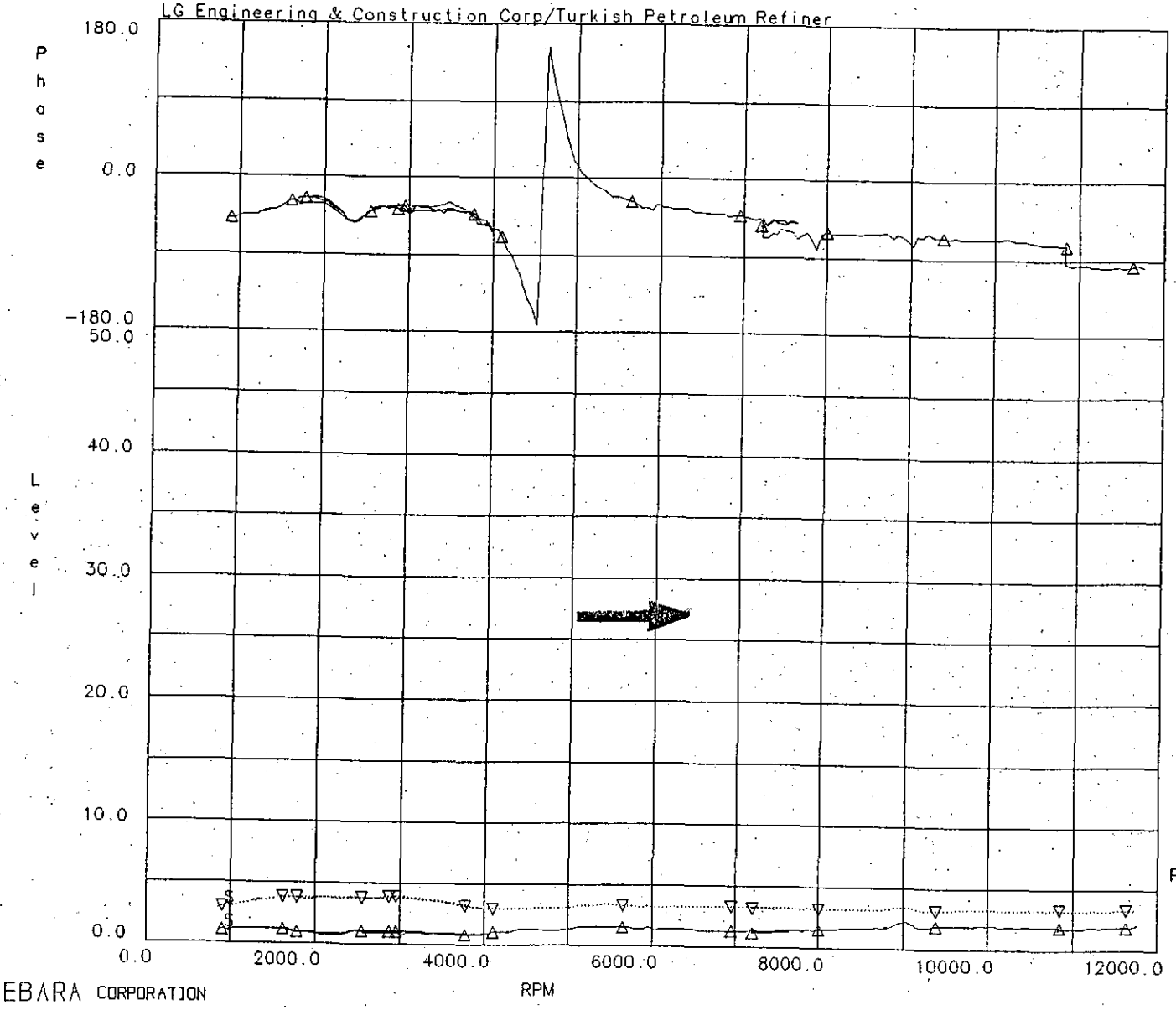
LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
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EBARA CORPORATION

Wed Oct 1 10:05:49 2003

2 Record for Compressor

2-2 Vibration Amplitude Record

b Bode Plot of Coast Down

[Note]

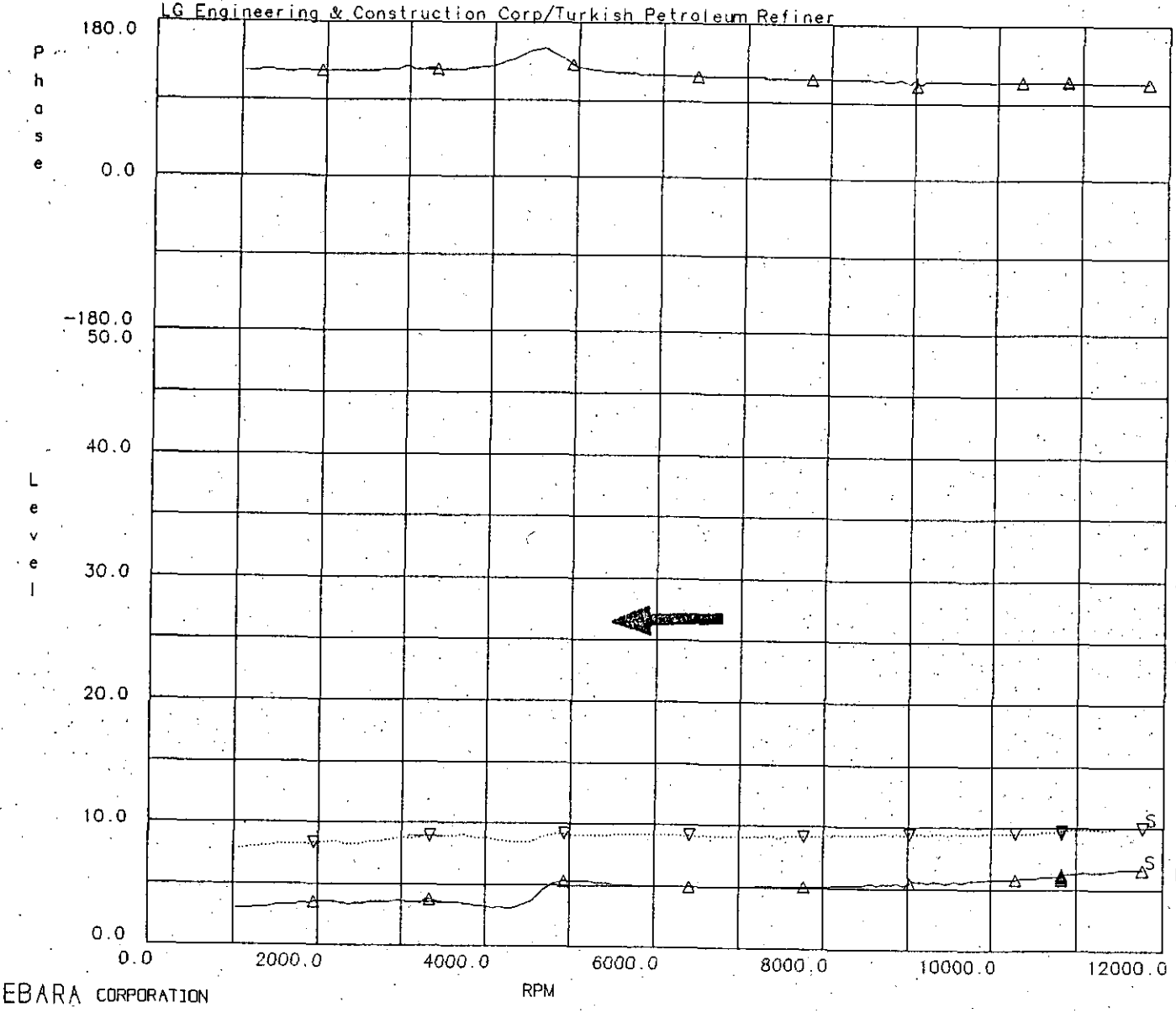
C.CP.X	:	Drive End X
C.CP.Y	:	Drive End Y
C.OCP.X	:	Non Drive End X
C.OCP.Y	:	Non Drive End Y

EO : 1.0	:	Synchronous Frequency
TOTAL	:	Overall
Unit	.	Vibration : μ m p-p
.	.	Phase : Degree
.	.	.

R0215708
25MB5

SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
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EBARA CORPORATION

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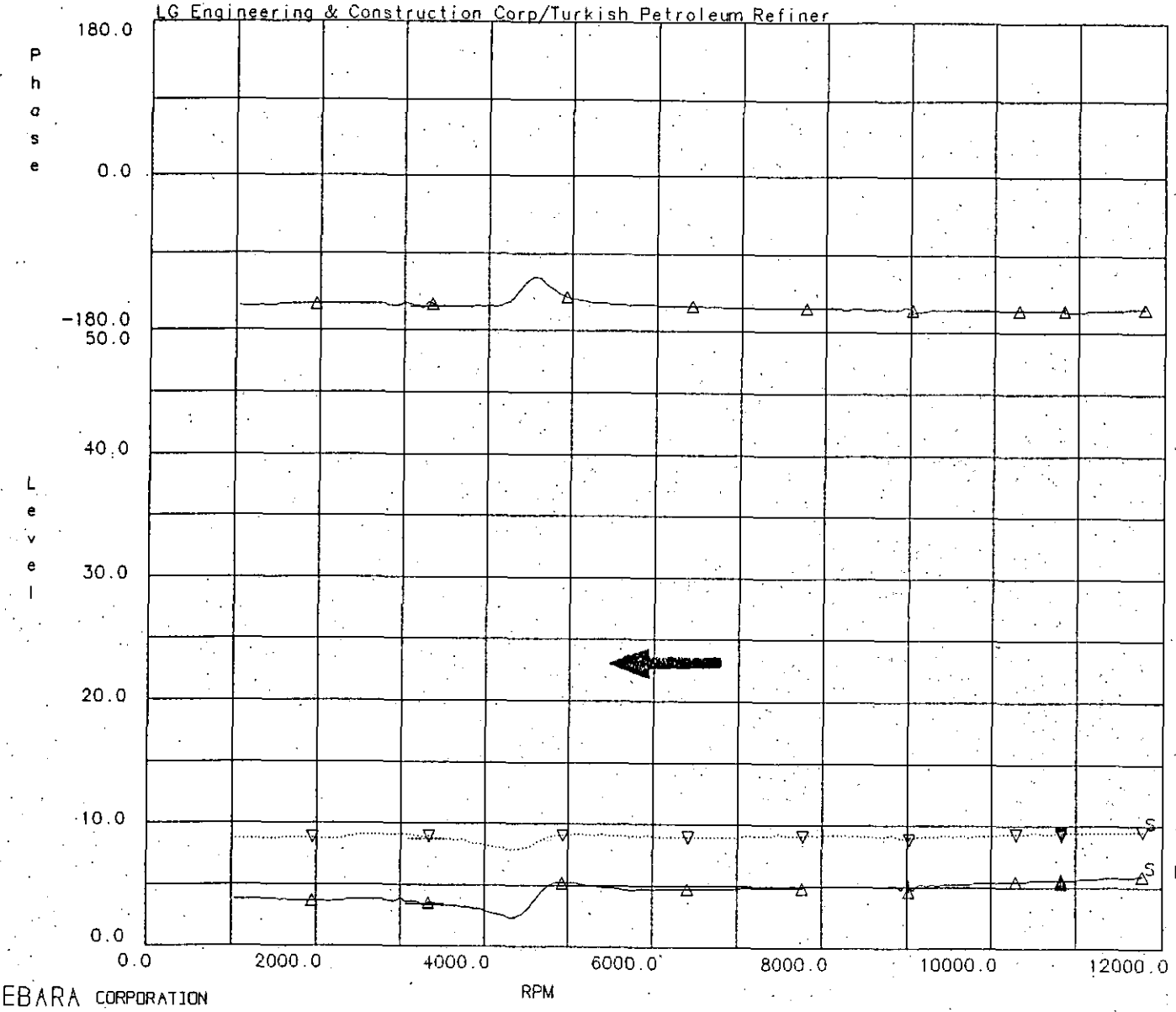
R0215708
25MB5

SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
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EBARA CORPORATION

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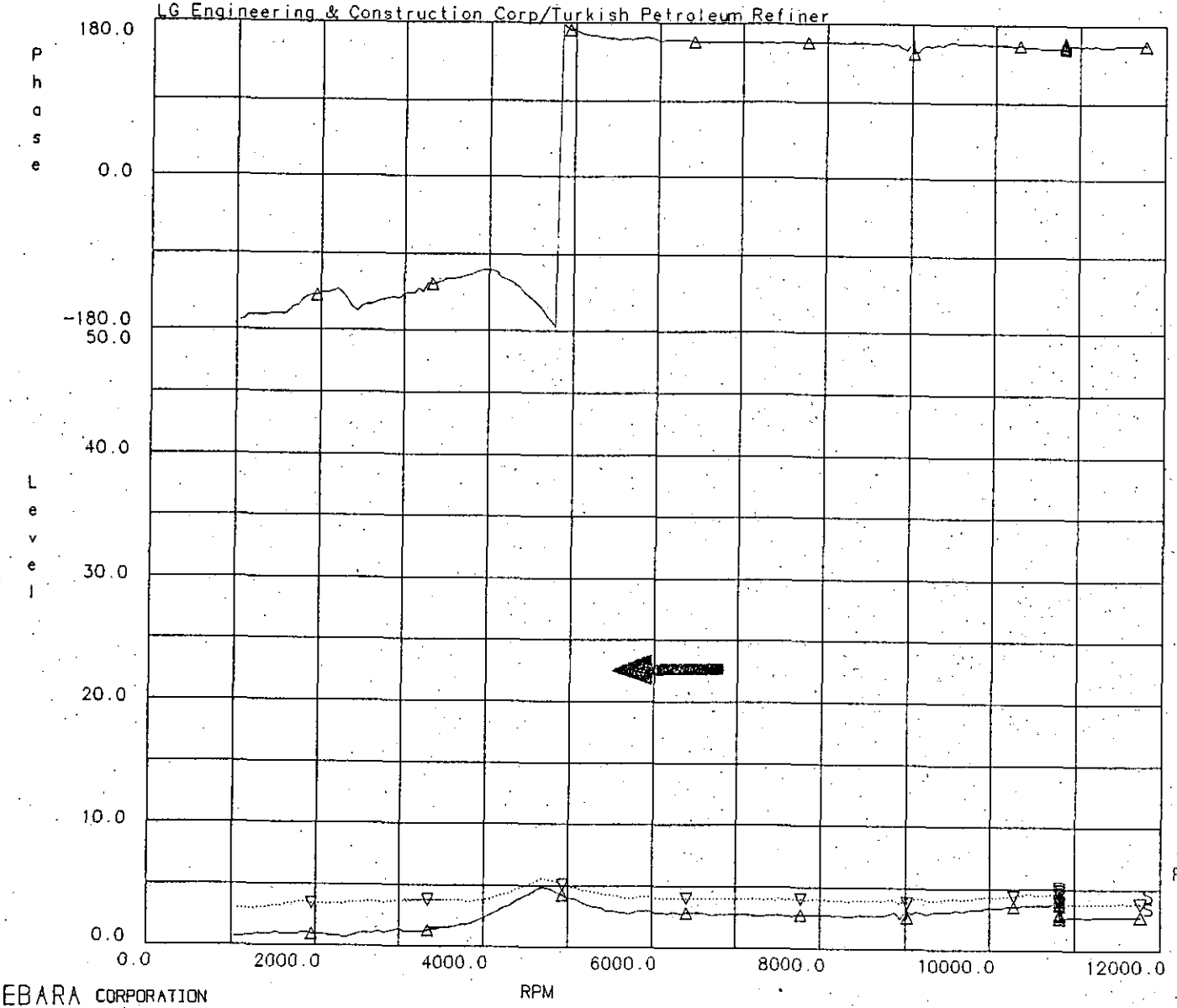
25MB5

SRV--5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
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LG E&C

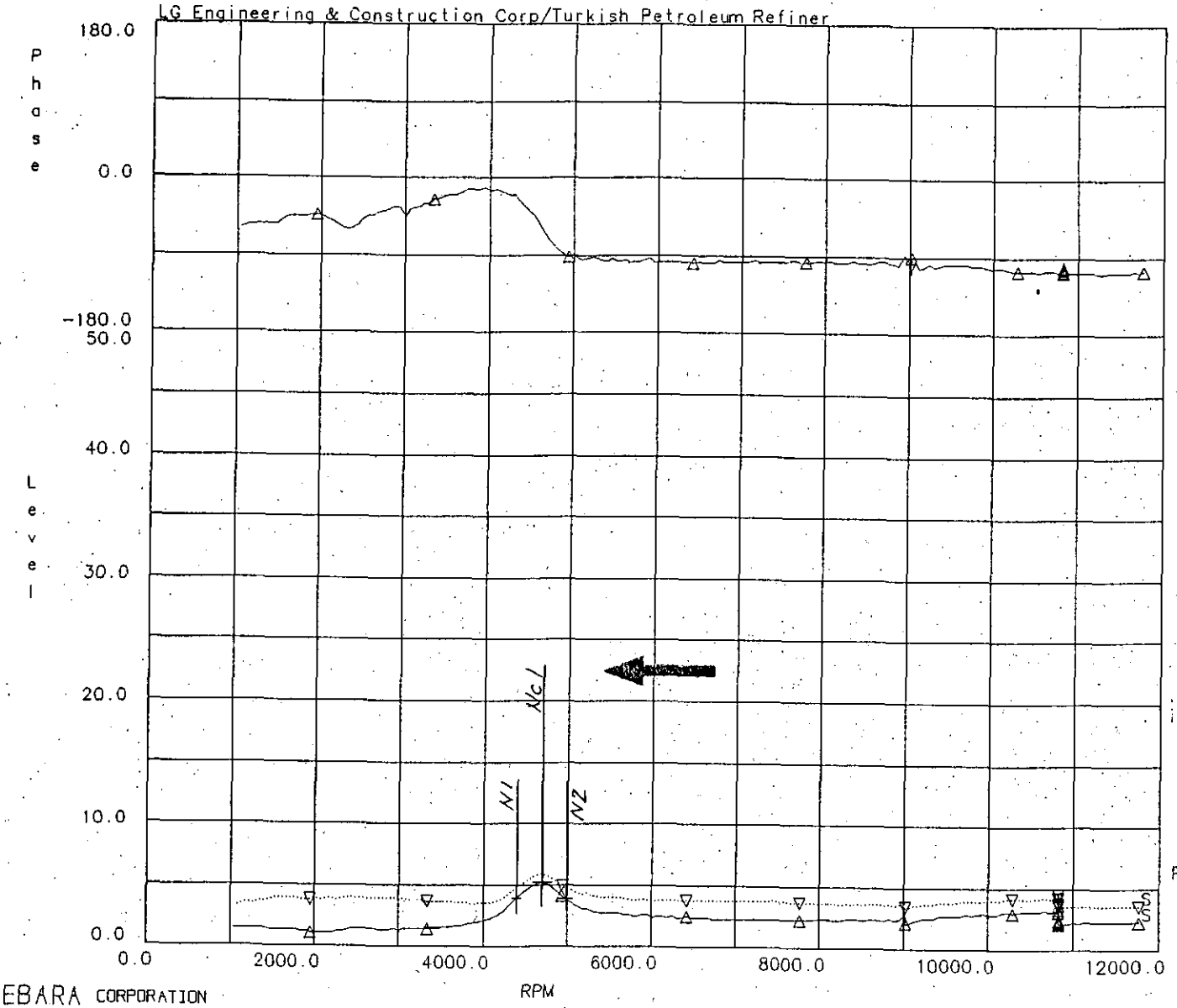
EBARA CORPORATION

Wed Oct 1 10:05:49 2003

R0215708
25MB5

SRV--5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



△ C.OCP.Y EO: 1.0

▽ C.OCP.Y TOTAL

AF = Nc.1 / (N2-N1)
= 4699 / (4998 - 4382)
= **7.63**

SM ≧ 100 - (84 + 6 / (AF - 3))
≧ 100 - (84 + 6 / (7.63 - 3))
≧ **14.7 %**

SM test = (Nmin - Nc.1) / Nmin
=(7218 - 4699) / 7218
= **34.9 %**

(Min.Speed = 7218 rpm)

INSPECTION TEAM
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EBARA CORPORATION

Wed Oct 1 10:05:49 2003

2 Record for Compressor

2-3 Vibration Sweep Record

at MCS

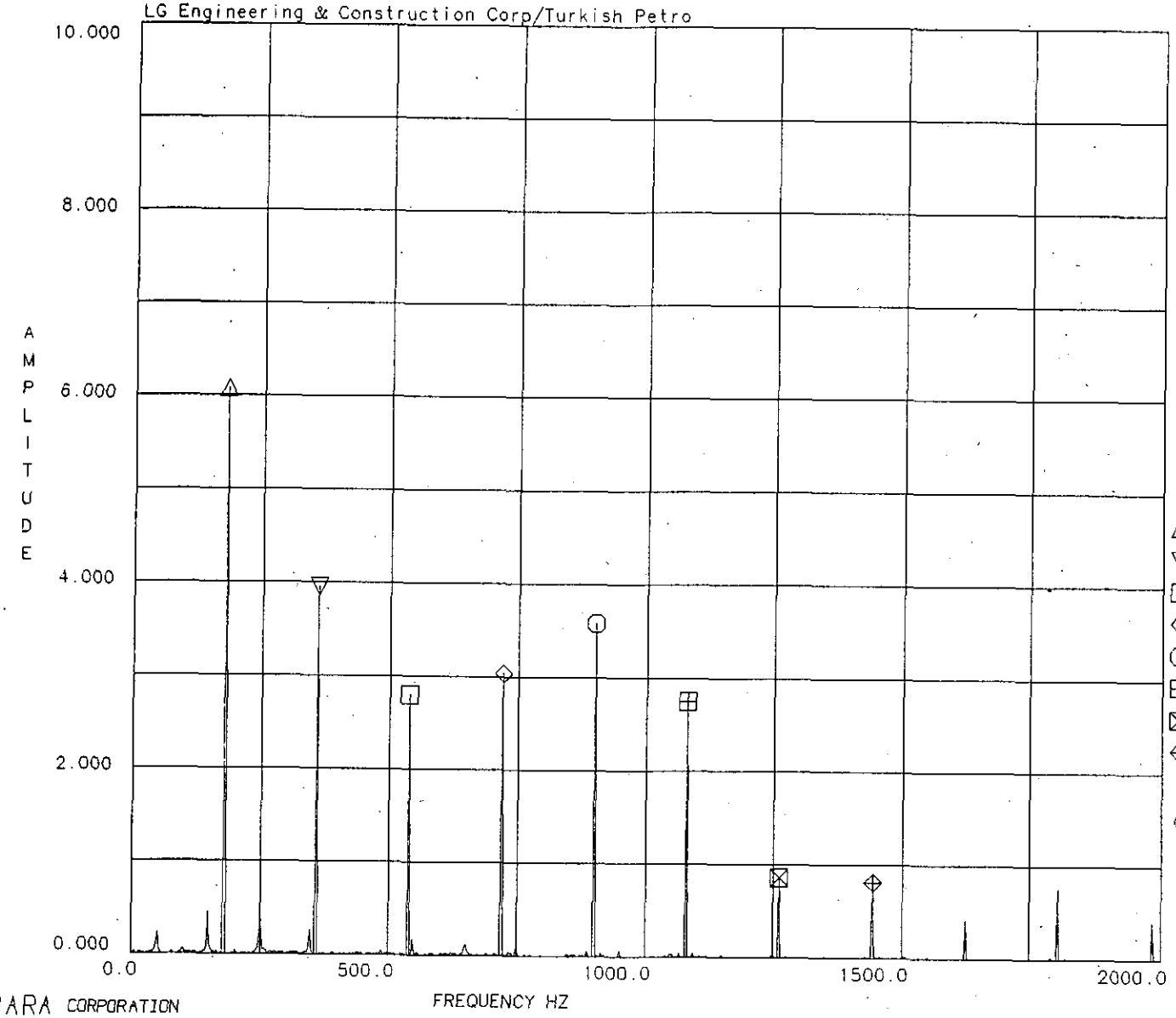
(Note)

C.CP.X	:	Drive End X
C.CP.Y	:	Drive End Y
C.OCP.X	:	Non Drive End X
C.OCP.Y	:	Non Drive End Y

Unit : μm p-p

R0215708
25MB5

SRV-5DF
LG Engineering & Construction Corp/Turkish Petro



C.CP.X

P-P

N1 rpm10827
TIME 15:35:01

	FREQ	AMP
△	180	6.082
▽	361	3.955
□	541	2.803
◇	722	3.036
○	902	3.587
⊞	1083	2.761
⊠	1263	0.869
⊕	1444	0.819

Overall 9.67

INSPECTION TEAM
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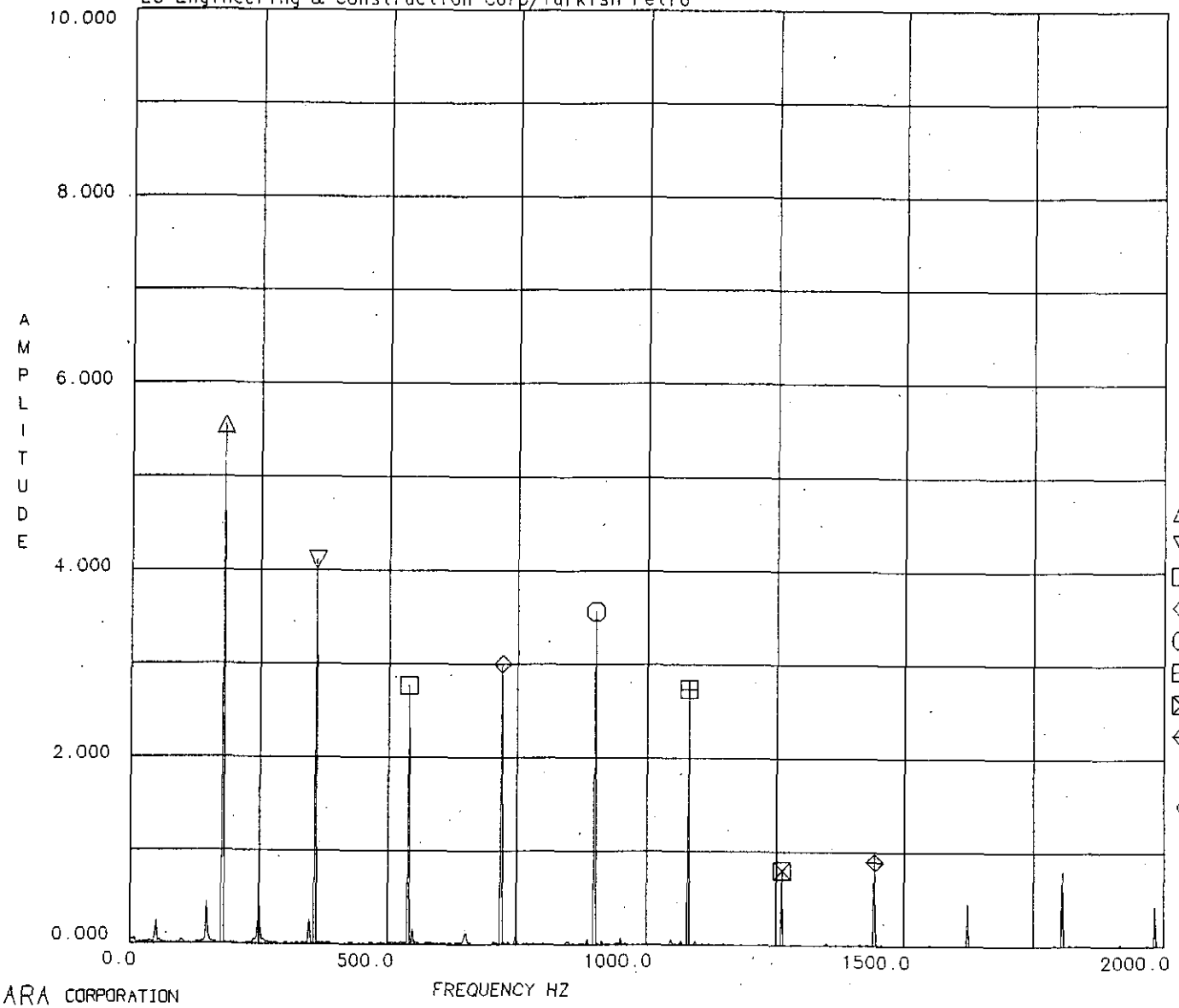
LG E&C

EBARA CORPORATION

Wed Oct 1 10:05:49 2003

R0215708
25MB5

SRV-5DF
LG Engineering & Construction Corp/Turkish Petro



C.CP.Y

P-P

N1 rpm10827
TIME 15:35:01

	FREQ	AMP
△	180	5.559
▽	361	4.117
□	541	2.780
◇	722	3.011
○	902	3.566
⊞	1083	2.738
⊠	1263	0.809
⊕	1444	0.900

Overall 9.40

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25MB5

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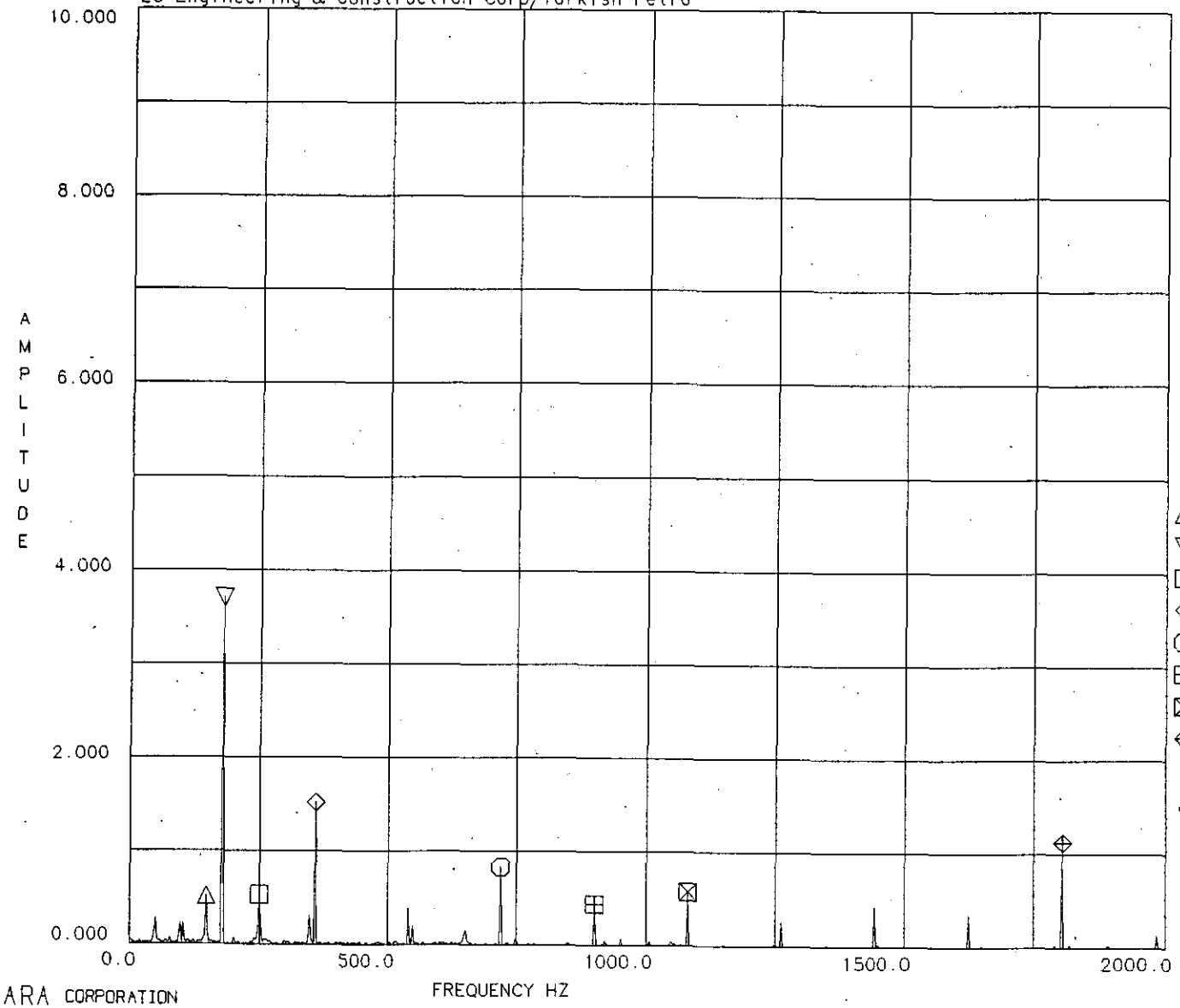

C.OCP.X

P-P

N1 rpm10827
TIME 15:35:01

	FREQ	AMP
△	149	0.519
▽	180	3.710
□	251	0.533
◇	361	1.518
⬡	722	0.843
⊞	902	0.453
⊠	1083	0.583
⊕	1804	1.131

Overall 4.53

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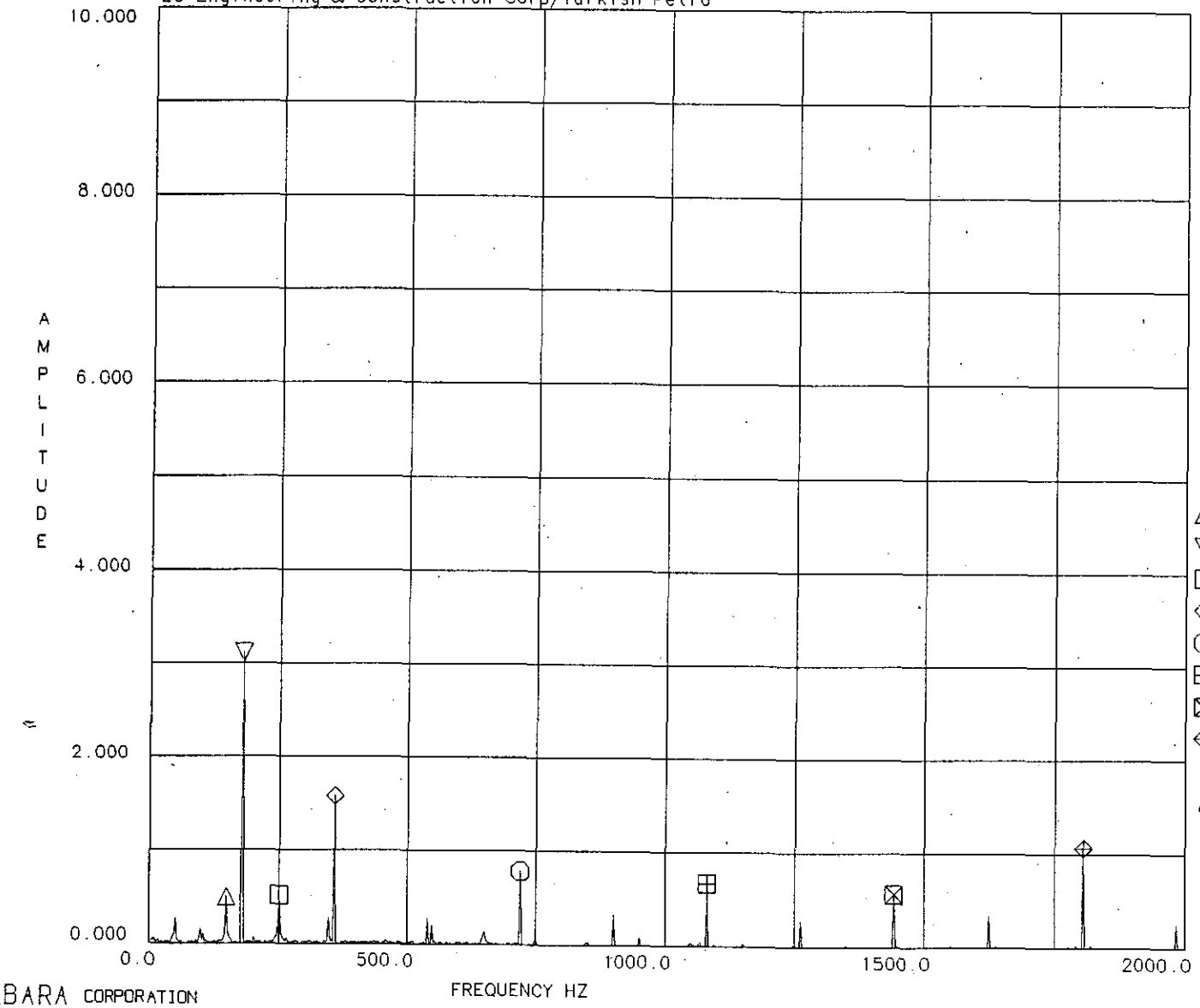
R0215708
25MB5

SRV-50F
LG Engineering & Construction Corp/Turkish Petro



C.OCP.Y

P-P

N1 rpm10827
TIME 15:35:01

	FREQ	AMP
△	149	0.514
▽	180	3.116
□	251	0.522
◇	361	1.585
○	722	0.789
⊞	1083	0.685
⊠	1444	0.577
⊕	1804	1.066

Overall 4.06

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2 Record for Compressor

2-4 Unbalance Verification Test Record

a Specification

SPECIFICATIONS

Shop Order : R021570802
Frame Size : 25MB5

Design Data

: Minimum Continuous Speed	7218	[RPM]	
: Design Speed	10312	[RPM]	
: Maximum Continuous Speed	10828	[RPM]	— MCS
: Over Speed	11911	[RPM]	— OVS
: Shaft Overhung Weight	9.4	[kgf]	

Coupling Data

	Journal End		Thrust End
: Manufacture	Eagle Industry		-
: Size	100E308		-
: Half Coupling Weight	15.3	[kgf]	-
: Length Between Shaft End	800	[mm]	-

Placed Unbalance

: Amounts	238.306	[g-mm]
: Location	Coupling	

Definition of Amounts of Unbalance(oz-in)

$$U = U_{cplg} + U_{shaft}$$

$$U_{cplg} = Max\left[\frac{40\ W_{cplg}}{N},\ 0.008\ W_{cplg},\ 0.1\right]$$

$$U_{shaft} = 8\frac{4\ W_{shaft}}{N}$$

where : W_{cplg} = Coupling Half Weight
W_{shaft} = Shaft Overhung Weight (Exclude W_{cplg})
N = Maximum Contimuous Speed

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2-4 Unbalance Verification Test Specification for Compressor

a Specification

S.O. No : R021570802
Model : 25MB5
Item No : CT-9901

TABLE 1
SEAL CLEARANCE VS AMPLITUDE
UNBALANCE AT COUPLING Major Axis (μm p-p)

STATION NO.	SEAL DESCRIPTION	ASS'Y CLEALANCE	75% CLEALANCE	Nc1	MCS	OVS
15	Buffer Laby	254.0	190.5	0.98	2.57	3.13
20	Stg.1 Eye	851.0	638.3	1.69	1.50	1.95
23	Stg.2 Shaft	690.8	518.1	2.17	0.73	1.05
24	Stg.2 Eye	851.0	638.3	2.33	0.46	0.69
27	Stg.3 Shaft	690.8	518.1	2.65	0.48	0.28
28	Stg.3 Eye	851.0	638.3	2.74	0.71	0.59
31	Stg.4 Shaft	690.8	518.1	2.87	1.24	1.28
32	Stg.4 Eye	851.0	638.3	2.88	1.42	1.53
34	Stg.5 Shaft	690.8	518.1	2.86	1.63	1.82
36	Stg.5 Eye	851.0	638.3	2.75	1.83	2.11
39	Balance Piston	249.0	186.8	2.39	1.92	2.28
45	Buffer Laby *	254.0	190.5	1.70	1.73	2.11

* ; This seal is constructed of abradable material and designed with reduced clearance to allow wearin during operation.

TABLE 2
AMPLITUDE AT THE PROBES
UNBALANCE AT COUPLING Major Axis (μm p-p)

		Nc1	MCS	OVS
DRIVE END	Major Axis	-	6.06	6.95
	Horizontal	-	5.64	6.50
	Vartical	-	5.97	6.87
FREE END	Major Axis	0.82	1.17	1.46
	Horizontal	0.80	1.08	1.36
	Vartical	0.68	1.06	1.36

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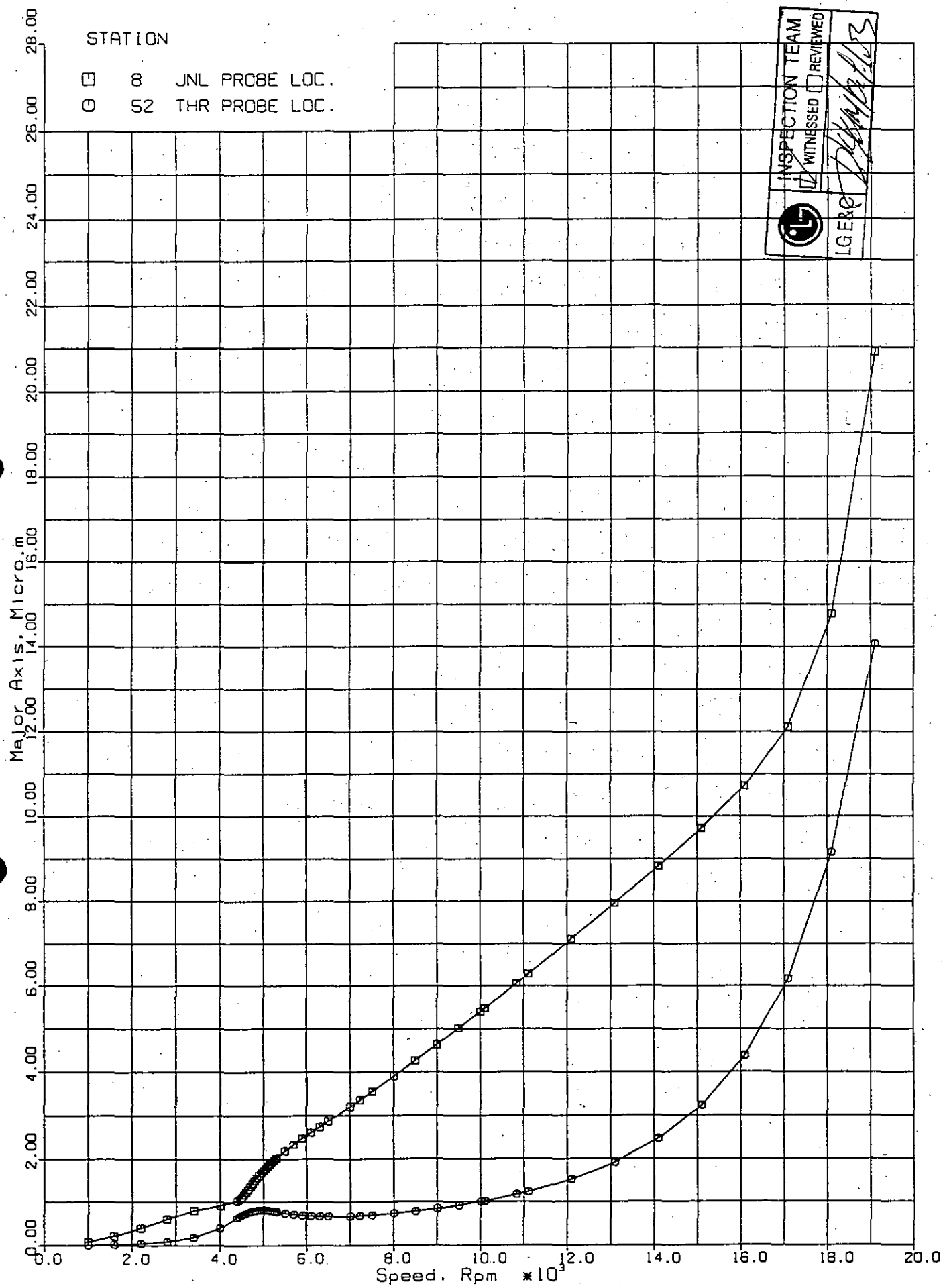
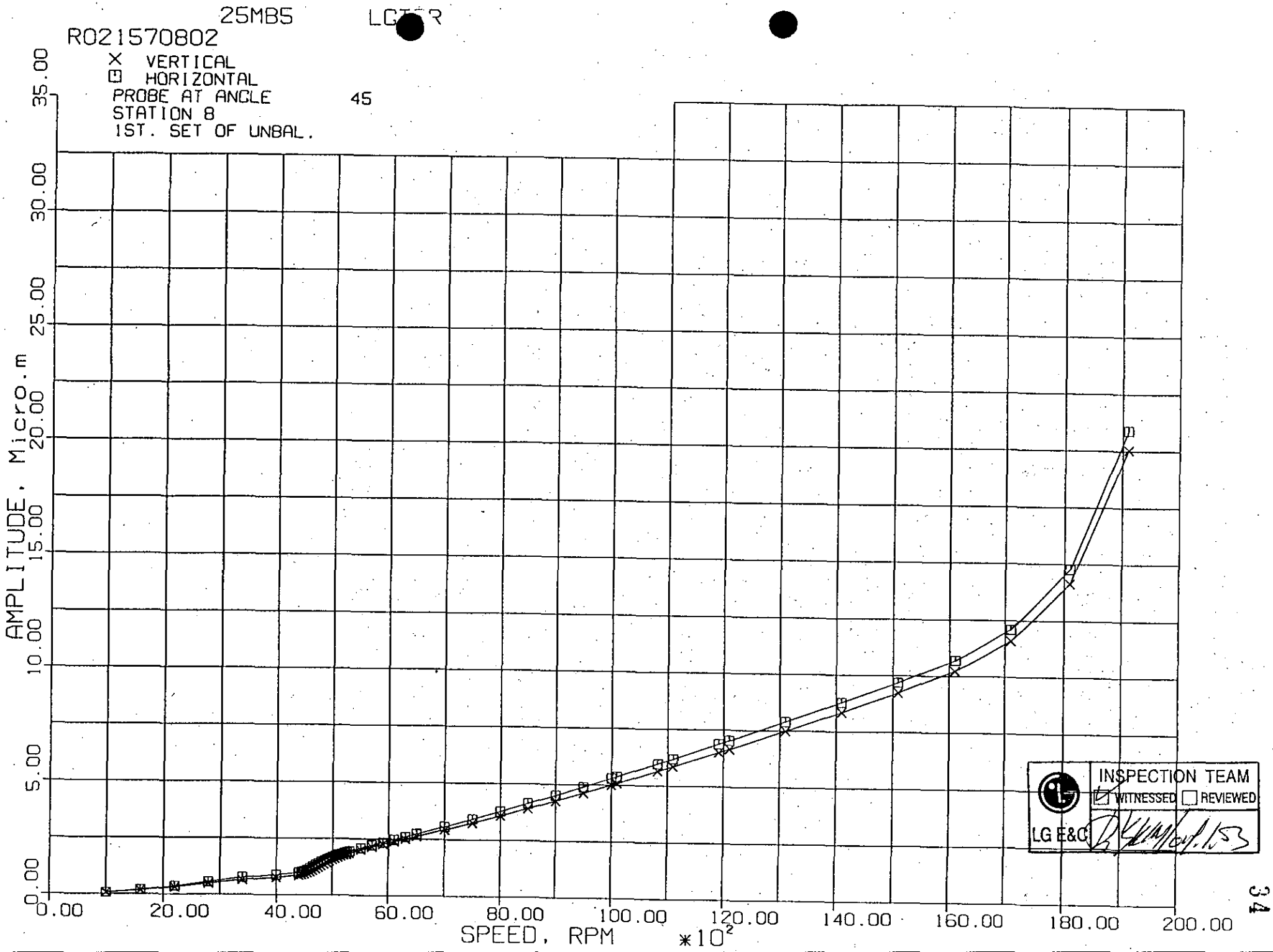


25MB5 LCTPR

R021570802

@ AVG. CLEARANCE

1ST. SET OF UNBAL.


25MB5 LGTR
R021570802
X VERTICAL
HORIZONTAL
PROBE AT ANGLE 45
STATION 8
1ST. SET OF UNBAL.
AMPLITUDE, Micro.m
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
200.00
SPEED, RPM *10²
INSPECTION TEAM
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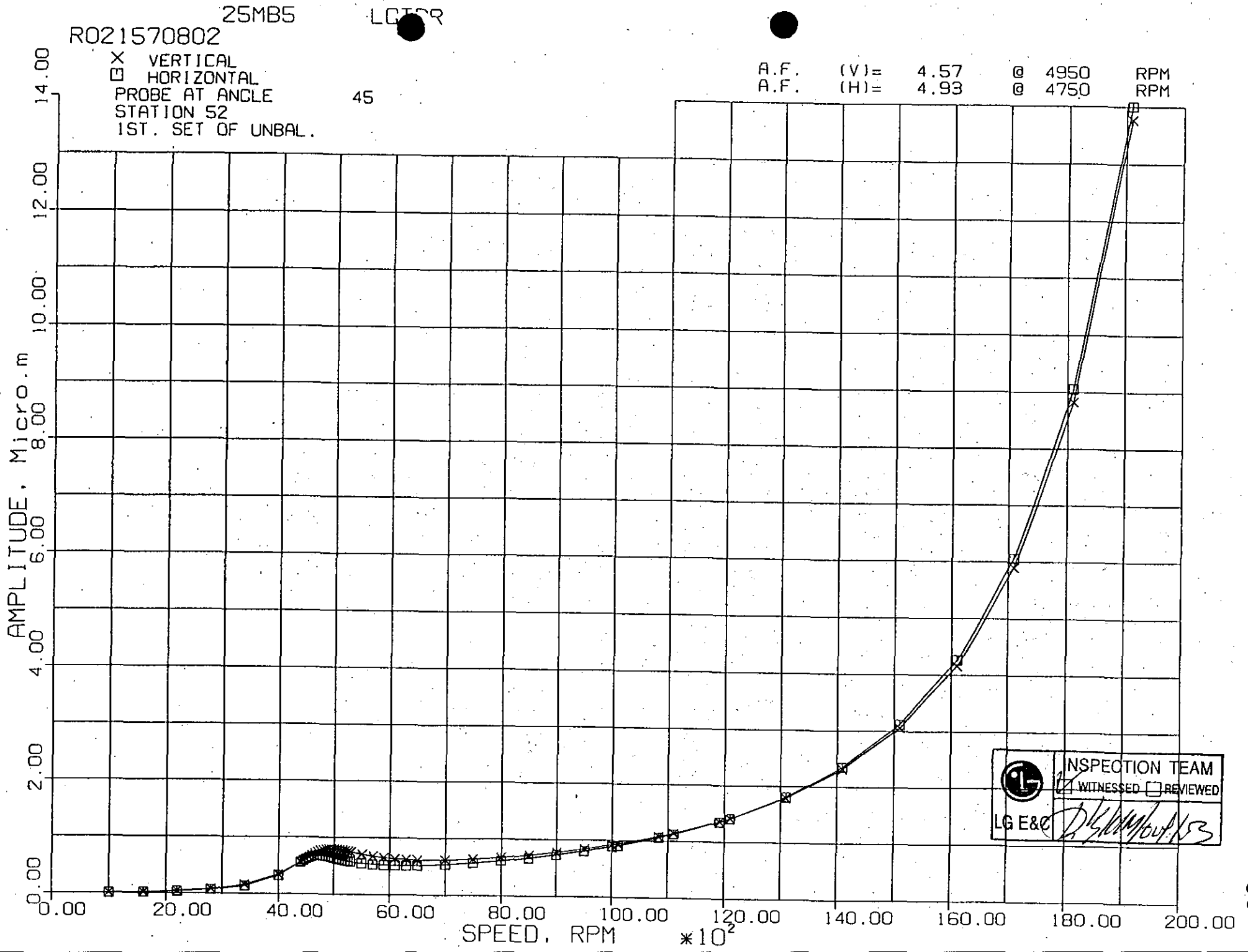
25MB5 LOOR
R021570802
X VERTICAL
HORIZONTAL
PROBE AT ANGLE 45
STATION 52
1ST. SET OF UNBAL.
A.F. (V)= 4.57 @ 4950 RPM
A.F. (H)= 4.93 @ 4750 RPM
AMPLITUDE, Micro.m
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
200.00
SPEED, RPM *10²
INSPECTION TEAM
WITNESSED REVIEWED
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2 Record for Compressor

2-4 Unbalance Verification Test Record

b Test Results

2-4 Unbalance Verification Test Result for Compressor

SO No.	:	R021570802	Item No	:	CT-9901
Model	:	25MB5	Rotor	:	A (Spare)

Following test data are refered to unbalance verification test data.

Item	Scope	Test Result	Deviation
CRITICAL SPEED	Deviation of the actual critical speeds ≦ ±5% of the predicted critical speeds		
DRIVE END X	- rpm	- rpm	-
DRIVE END Y	- rpm	- rpm	-
NON DRIVE END X	4950 rpm	4731 rpm	95.6%
NON DRIVE END Y	4750 rpm	4579 rpm	96.4%
AMPLIFICATION FACTOR	Deviation of the actual amplification factor (AF) ≦ ±20% of the predicted AF		
DRIVE END X	-	-	-
DRIVE END Y	-	-	-
NON DRIVE END X	4.57	5.35	117.1%
NON DRIVE END Y	4.93	5.91	119.8%
SEPARATION MARGIN	Separation margin calculation based on the amplification factor AF<2.5 : *No Separation Margin Required.* 2.5≦AF≦3.55 : 5% Below Minimum Speed → 3.55≦AF ; SM≧100-(84+6/(AF-3)) [%] Actual separation margin based on test result Separation margine = (Nmin-Nc1)/Nmin (Nmin= 7218. rpm)		
DRIVE END X	Required No Separation Margen Required	-	-
DRIVE END Y	Required No Separation Margen Required	-	-
NON DRIVE END X	Required SM≧100-(84+6/(AF-3)) [%] ≧ 13.4 [%]	34.5%	-
NON DRIVE END Y	Required SM≧100-(84+6/(AF-3)) [%] ≧ 13.9 [%]	36.6%	-
PEAK AMPLITUDE	Deviation of the actual amplitudes ≦ ±50% of the predicted amplitudes		
DRIVE END X	- μmp-p	- μmp-p	-
DRIVE END Y	- μmp-p	- μmp-p	-
NON DRIVE END X	0.68 μmp-p	0.88 μmp-p	129.4%
NON DRIVE END Y	0.80 μmp-p	0.60 μmp-p	75.0%

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INSPECTION TEAM
☑ WITNESSED ☐ REVIEWED

Test Date 01-Oct-03

Test Engineer N. Ishikawa

SO No.	:	R021570802
Model	:	25MB5
Item No	:	CT-9901
Rotor	:	A (Spare)

2-4 Unbalance Verification Test Result for Compressor (at Ncr)

Verification test was conducted after the mechanical running test. The unbalance weight was installed on drive end coupling hub. Amounts was determined by 8 X Umax.
The value of the placed unbalance are as follows.

PLACED UNBALANCE LOCATION	AMOUNTS (g-mm)	P.C.D.of cplg bolt (mm)	unbalance weight (g)
COUPLING HUB	238.3	204.8	2.33

MEASURED VALUE (at Ncr)

MODEL	Item No :	CT-9901	Item No :	CT-9901
PROBE LOCATION	NDE X	NDE Y	DE X	DE Y
MEASURED VIBRATION (μm p-p) RUN WITHOUT WEIGHT	4.84	5.20	-	-
MEASURED VIBRATION (μm p-p) RUN WITH UNBALANCE WEIGHT	4.62	5.07	-	-
MEASURED PHASE (deg) RUN WITHOUT WEIGHT	-162.70	-70.39	-	-
MEASURED PHASE (deg) RUN WITH UNBALANCE WEIGHT	-173.06	-76.95	-	-
OBTAINED VECTOR CHANGE (μm p-p) [MEASURED]	0.88	0.60	-	-
CALCULATED AMPLITUDE WITH UNBALANCE WEIGHT (μm p-p)	0.68	0.80	-	-
RATIO ALONG WITH ANALYTICAL VALUE	1.30	0.75	-	-

RESULT

MAXIMUM VIBRATION AMPLITUDE
ITS CALCULATED BY ABOVE TEST RESULT

SEAL DESCRIPTION	AMPLITUDE (μm p-p MAJOR AXIS)	75% CLEARANCE DIA.(μm p-p)
31 Stg.4 Shaft	3.72	518.1

INSPECTION TEAM
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LG E&C

Acceptable

This description has the most severe clearance, and the calculated value of the vibration is less than 75% minimum clearance.

H. [signature] Oct 3 '03

SO No.	:	R021570802
Model	:	25MB5
Item No	:	CT-9901
Rotor	:	A (Spare)

2-4 Unbalance Verification Test Result for Compressor (at MCS)

Verification test was conducted after the mechanical running test. The unbalance weight was installed on drive end coupling hub. Amounts was determined by 8 X Umax.
The value of the placed unbalance are as follows.

PLACED UNBALANCE LOCATION	AMOUNTS (g-mm)	P.C.D.of cplg bolt (mm)	unbalance weight (g)
COUPLING HUB	238.3	204.8	2.33

MEASURED VALUE (at MCS)

MODEL	Item No :	CT-9901	Item No :	CT-9901
PROBE LOCATION	NDE X	NDE Y	DE X	DE Y
MEASURED VIBRATION (μm p-p) RUN WITHOUT WEIGHT	2.68	2.19	6.24	5.59
MEASURED VIBRATION (μm p-p) RUN WITH UNBALANCE WEIGHT	3.62	3.02	8.96	8.35
MEASURED PHASE (deg) RUN WITHOUT WEIGHT	157.01	-107.48	113.47	-155.65
MEASURED PHASE (deg) RUN WITH UNBALANCE WEIGHT	145.35	-123.54	94.36	-172.29
OBTAINED VECTOR CHANGE (μm p-p) [MEASURED]	1.13	1.10	3.69	3.40
CALCULATED AMPLITUDE WITH UNBALANCE WEIGHT (μm p-p)	1.08	1.06	5.64	5.97
RATIO ALONG WITH ANALYTICAL VALUE	1.05	1.03	0.65	0.57

RESULT

MAXIMUM VIBRATION AMPLITUDE
ITS CALCULATED BY ABOVE TEST RESULT

SEAL DESCRIPTION	AMPLITUDE (μm p-p MAJOR AXIS)	75% CLEARANCE DIA.(μm p-p)
15 Buffer Laby	2.70	190.5

LG E&C | INSPECTION TEAM ☑ WITNESSED ☐ REVIEWED

Acceptable

This description has the most severe clearance, and the calculated value of the vibration is less than 75% minimum clearance.

Oct 3 '03

SO No.	:	R021570802
Model	:	25MB5
Item No	:	CT-9901
Rotor	:	A (Spare)

2-4 Unbalance Verification Test Result for Compressor (at OVS)

Verification test was conducted after the mechanical running test. The unbalance weight was installed on drive end coupling hub. Amounts was determined by 8 X Umax.
The value of the placed unbalance are as follows.

PLACED UNBALANCE LOCATION	AMOUNTS (g-mm)	P.C.D.of cplg bolt (mm)	unbalance weight (g)
COUPLING HUB	238.3	204.8	2.33

MEASURED VALUE (at OVS)

MODEL	Item No : CT-9901		Item No : CT-9901	
PROBE LOCATION	NDE X	NDE Y	DE X	DE Y
MEASURED VIBRATION (μm p-p) RUN WITHOUT WEIGHT	2.80	2.35	6.62	5.94
MEASURED VIBRATION (μm p-p) RUN WITH UNBALANCE WEIGHT	3.93	3.38	9.58	9.10
MEASURED PHASE (deg) RUN WITHOUT WEIGHT	158.34	-104.43	113.97	-151.60
MEASURED PHASE (deg) RUN WITH UNBALANCE WEIGHT	147.25	-123.04	95.56	-171.38
OBTAINED VECTOR CHANGE (μm p-p) (MEASURED)	1.30	1.38	3.91	4.04
CALCULATED AMPLITUDE WITH UNBALANCE WEIGHT (μm p-p)	1.36	1.36	6.50	6.87
RATIO ALONG WITH ANALYTICAL VALUE	0.96	1.01	0.60	0.59

RESULT

MAXIMUM VIBRATION AMPLITUDE
ITS CALCULATED BY ABOVE TEST RESULT

SEAL DESCRIPTION	AMPLITUDE (μm p-p MAJOR AXIS)	75% CLEARANCE DIA.(μm p-p)
15 Buffer Laby	3.17	190.5

LG E&C INSPECTION TEAM ☑ WITNESSED ☐ REVIEWED

Acceptable

This description has the most severe clearance, and the calculated value of the vibration is less than 75% minimum clearance.

H. Oct 3'03

2 Record for Compressor

2-4 Unbalance Verification Test Record

c Bode Plot of Start up

[Note]

C.CP.X	:	Drive End X
C.CP.Y	:	Drive End Y
C.OCP.X	:	Non Drive End X
C.OCP.Y	:	Non Drive End Y
EO : 1.0	:	Synchronous Frequency
TOTAL	:	Overall
Unit	:	Vibration : μm p-p
		Phase : Degree

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25MB5

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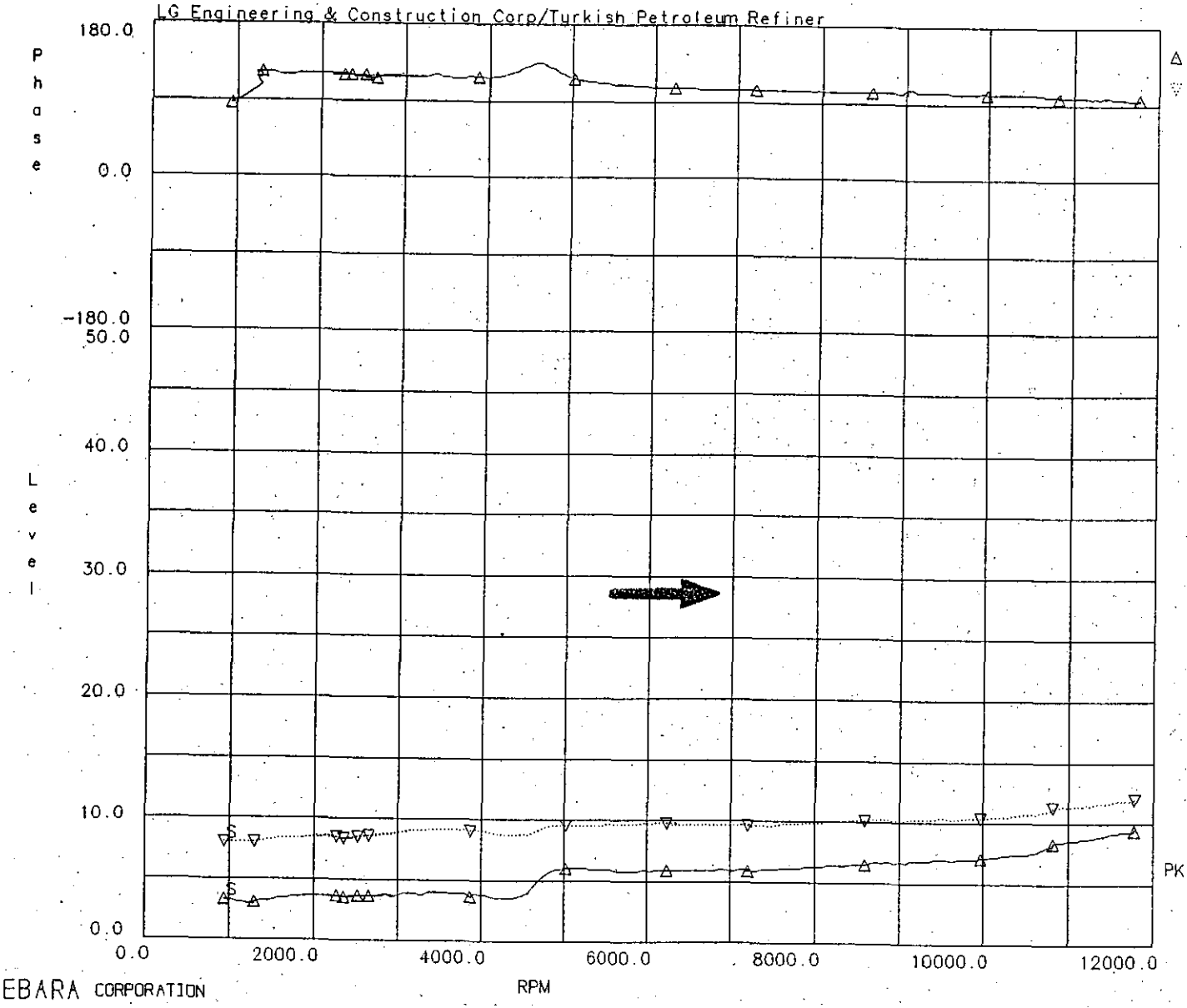

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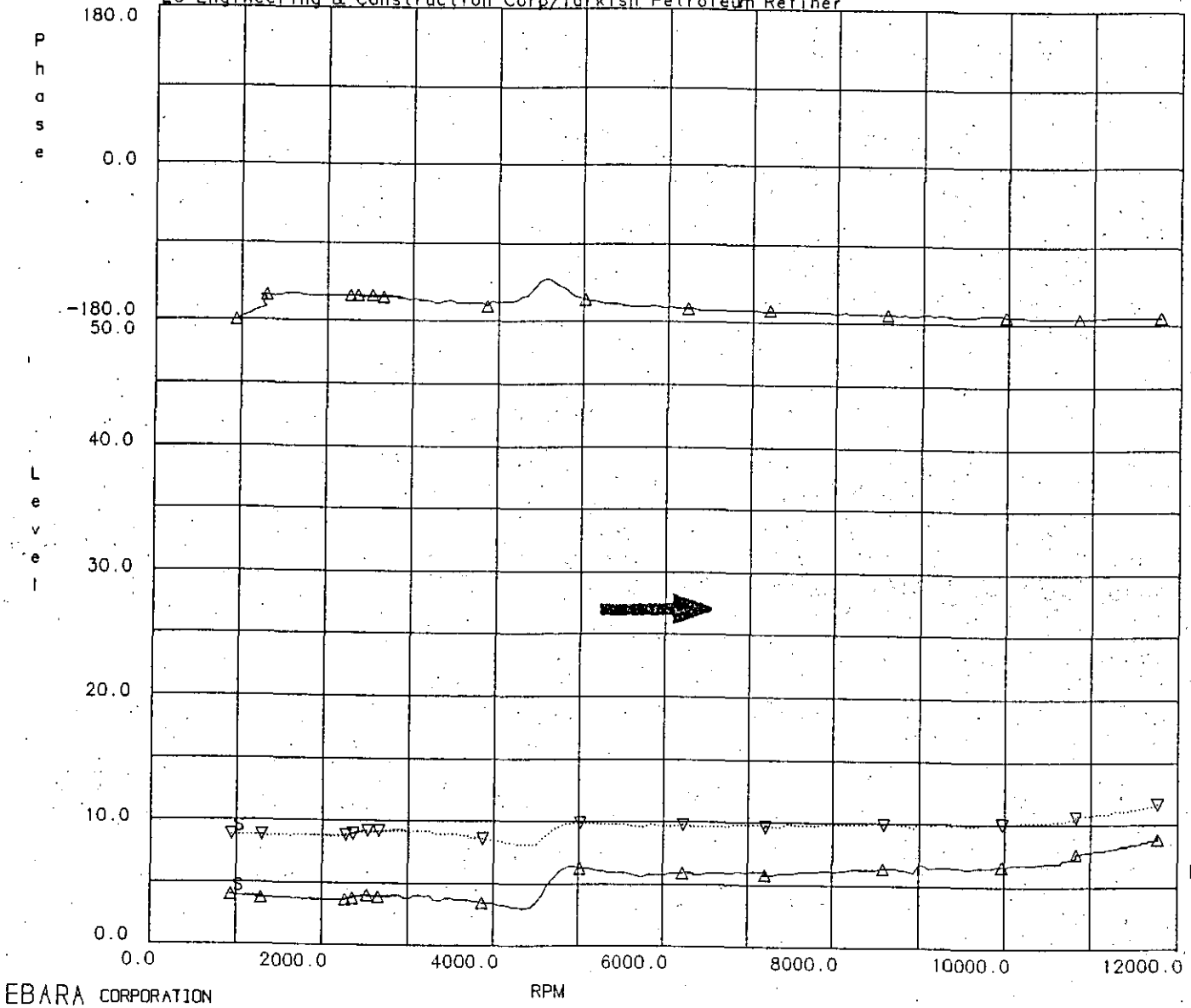

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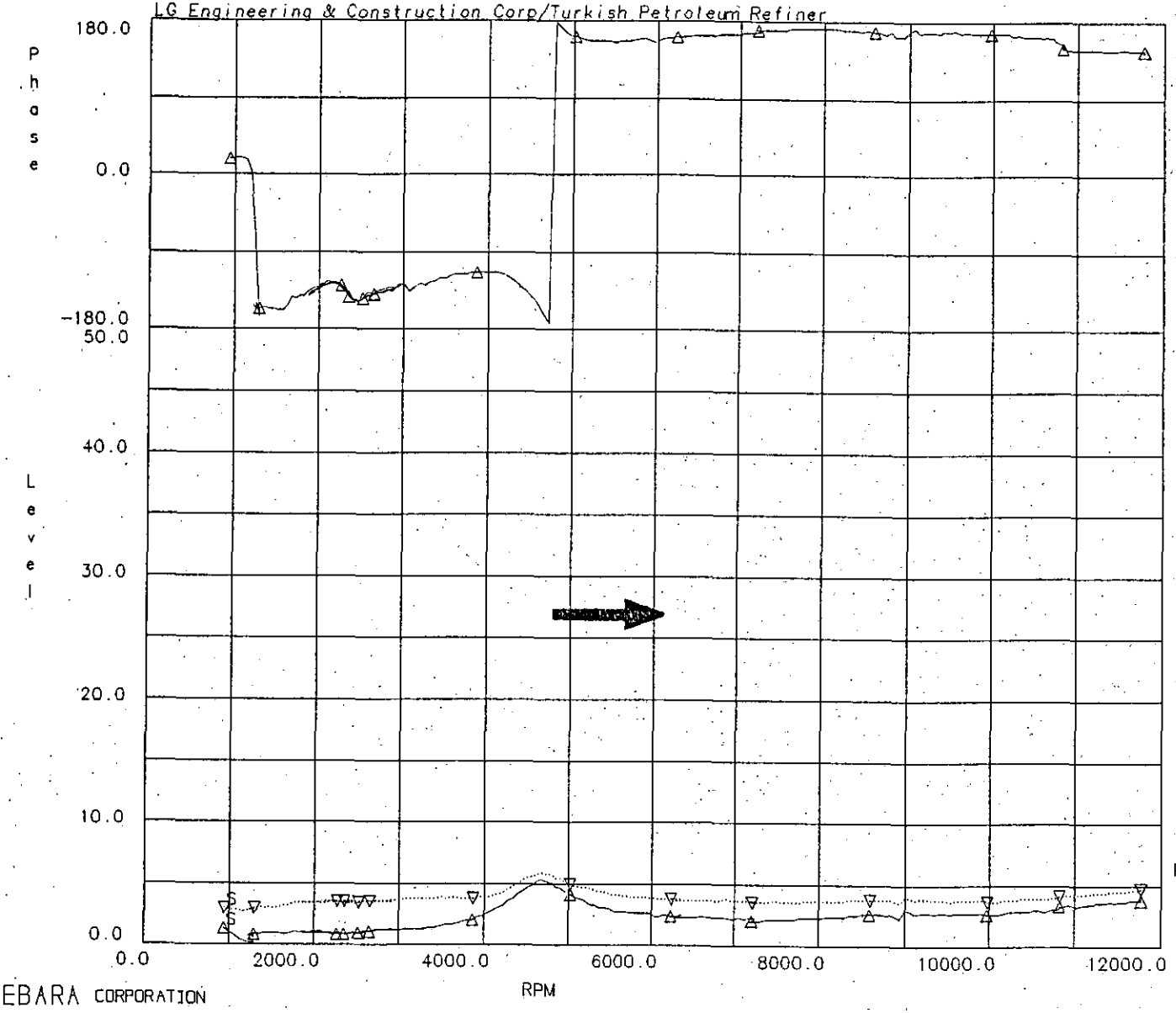

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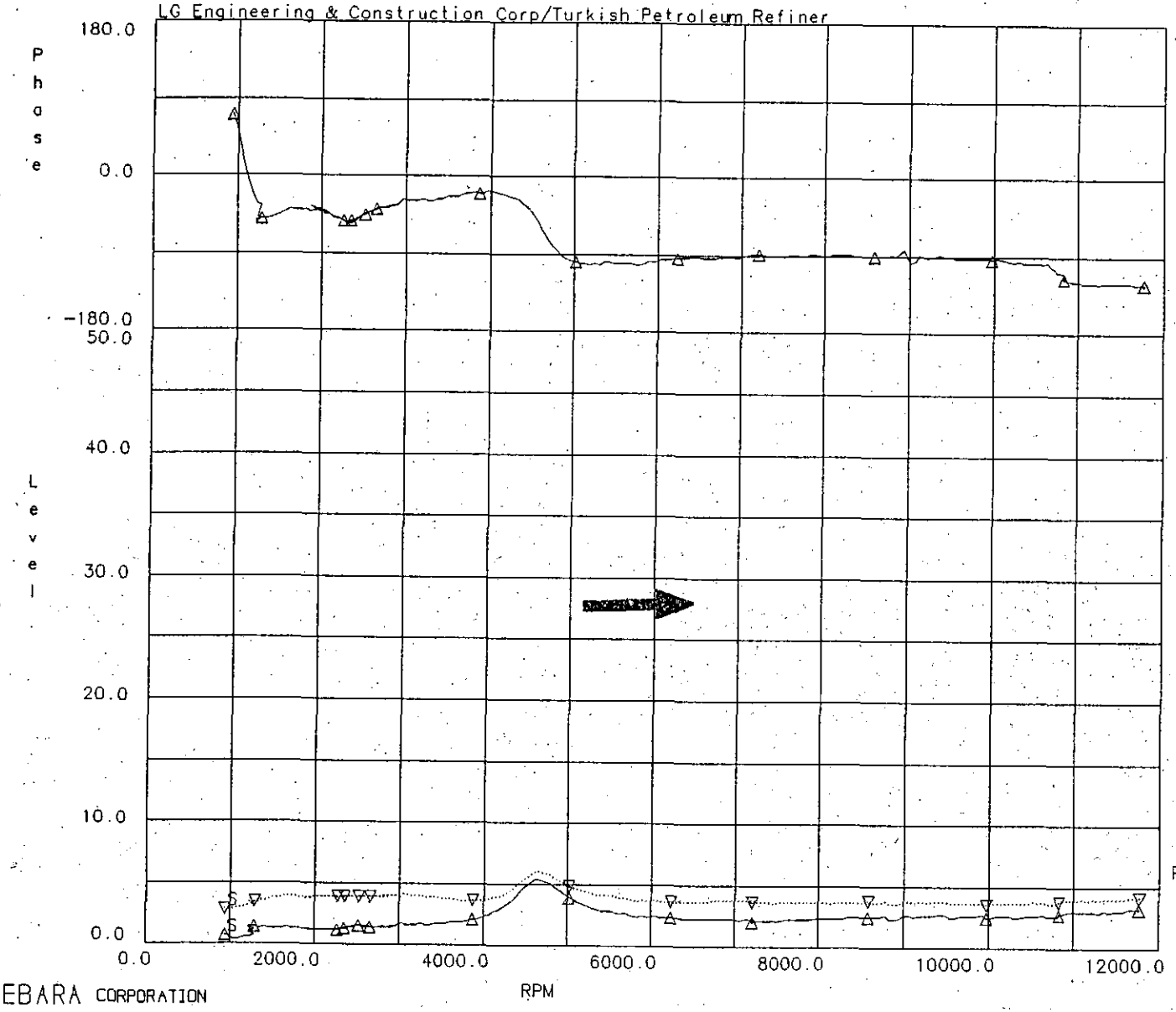

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2 Record for Compressor

2-4 Unbalance Verification Test Record

d Bode Plot of Coast Down

[Note]

C.CP.X	:	Drive End X
C.CP.Y	:	Drive End Y
C.OCP.X	:	Non Drive End X
C.OCP.Y	:	Non Drive End Y

EO : 1.0	:	Synchronous Frequency
TOTAL	:	Overall
Unit	:	Vibration : μ m p-p
	:	Phase : Degree

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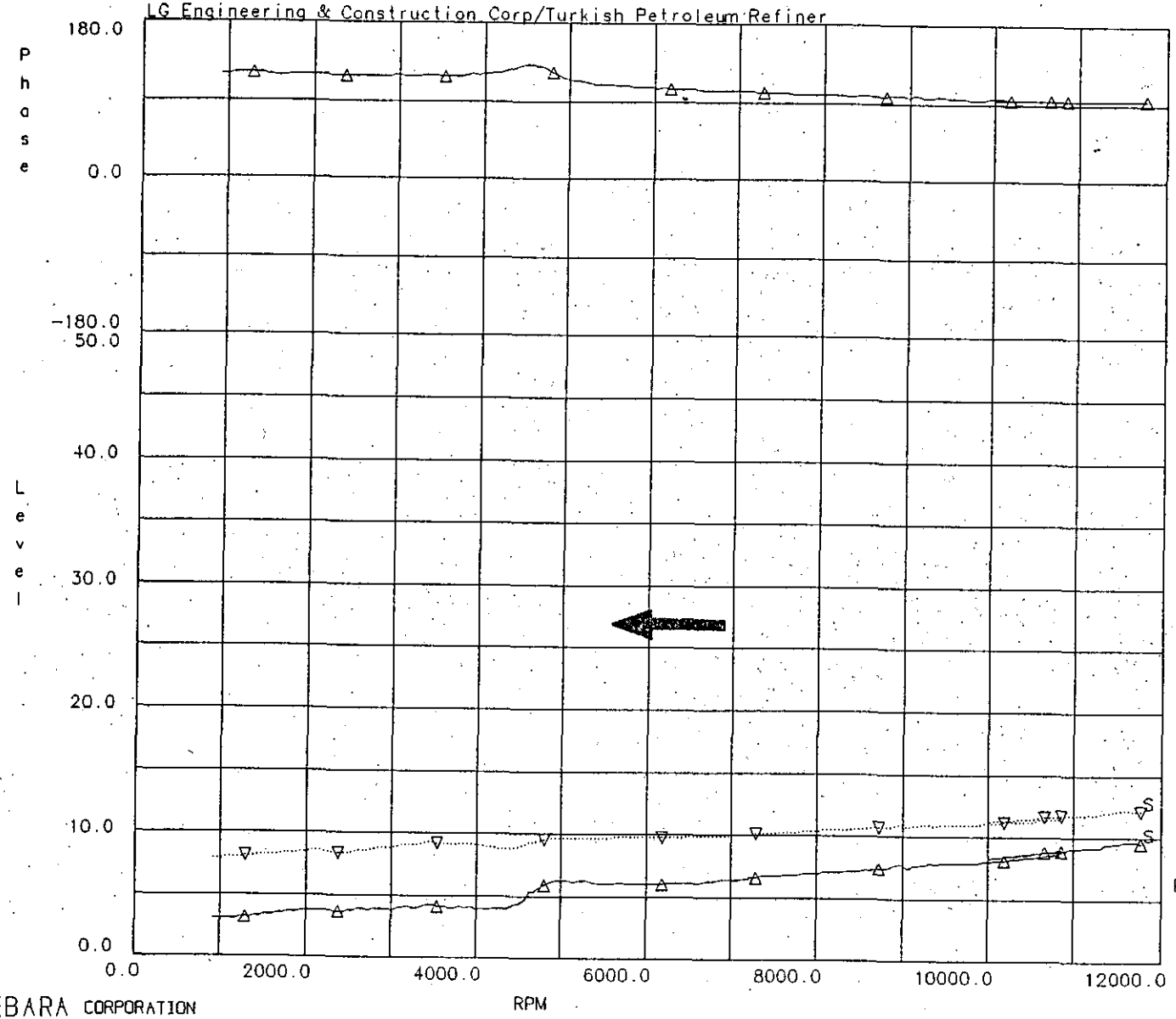

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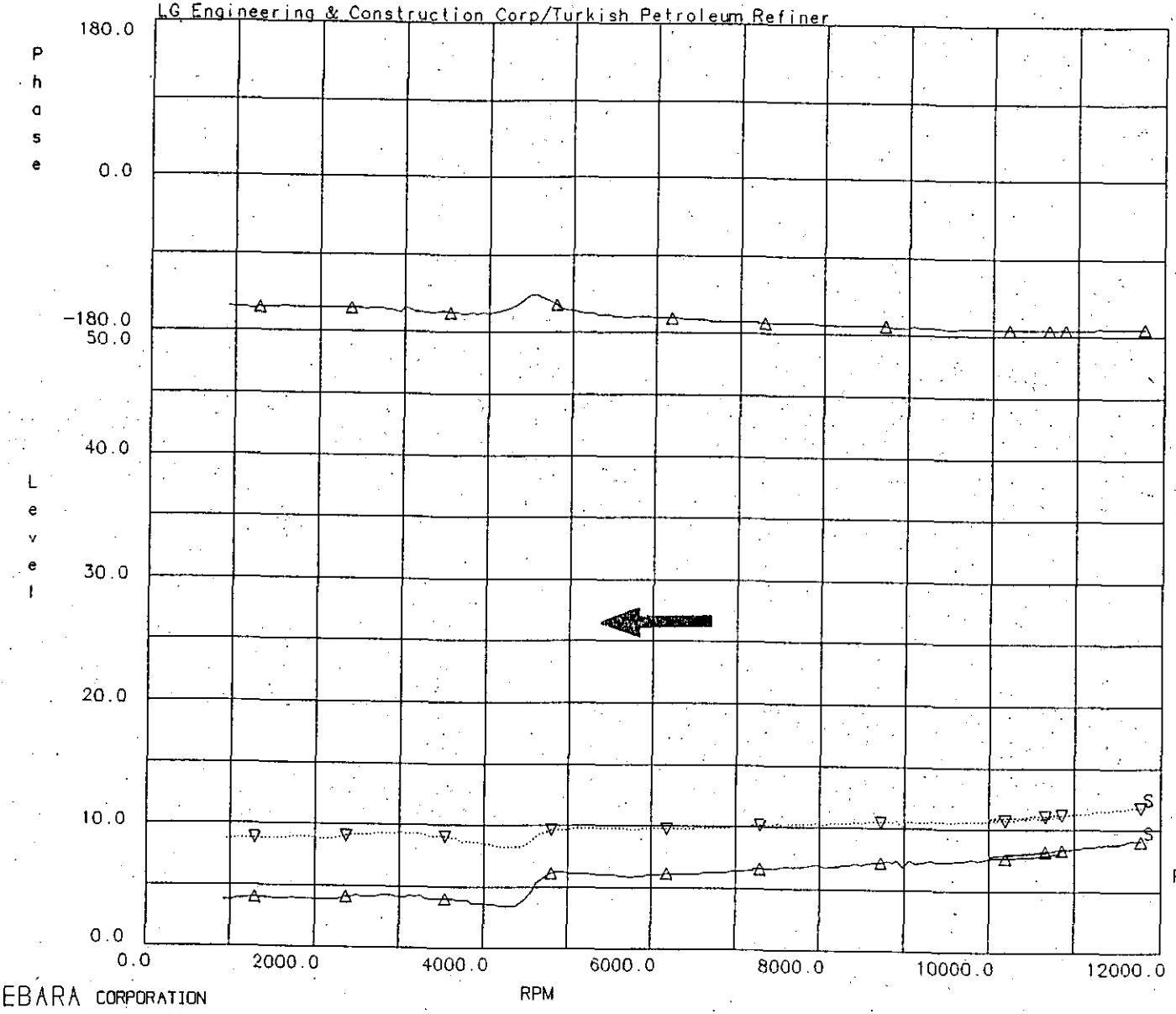

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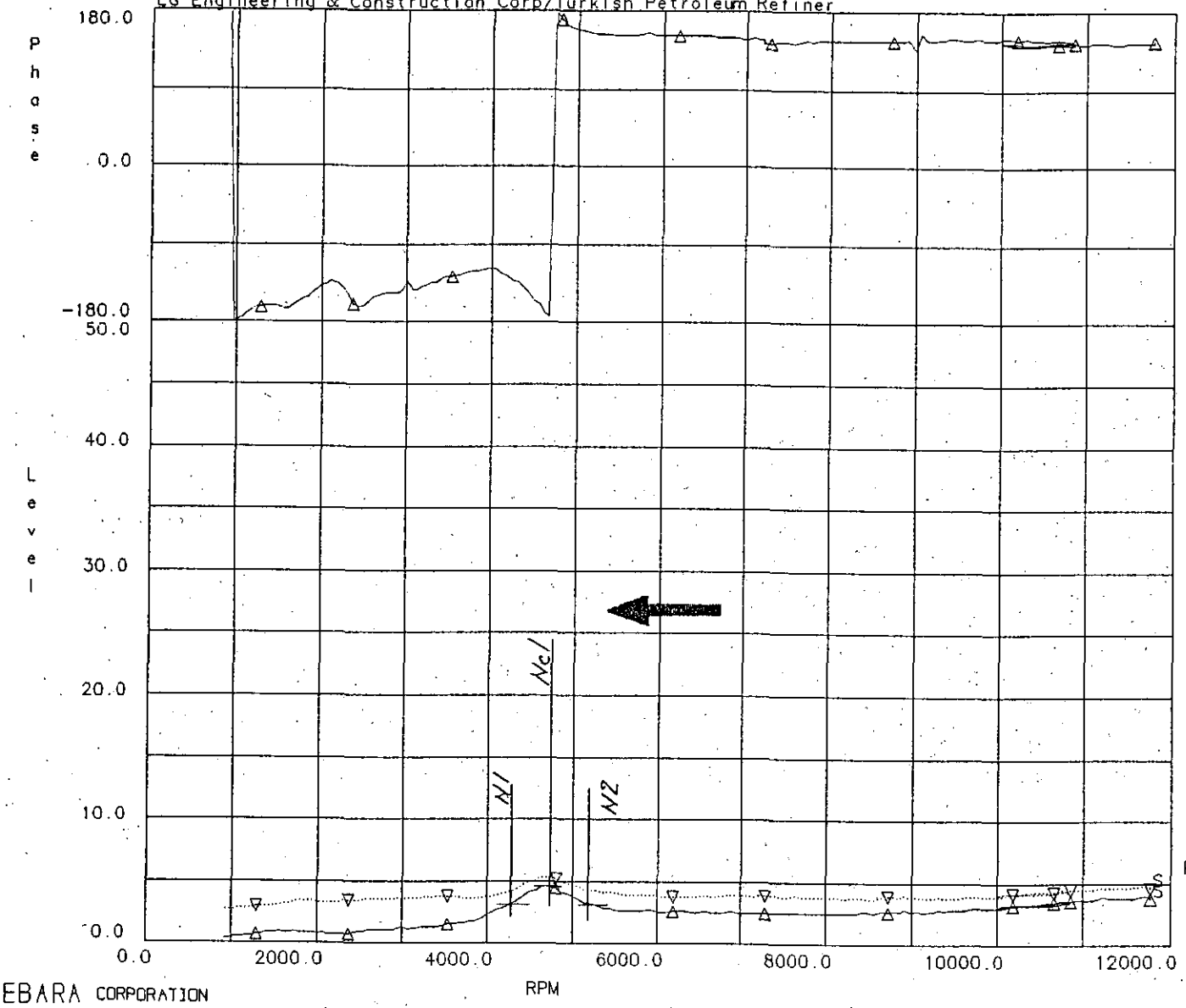

△ C.OCP.X EO: 1.0
▽ C.OCP.X TOTAL

AF = Nc.1 / (N2-N1)
= 4731 / (5185 - 4300)
= **5.35**

SM ≧ 100 - (84 + 6 / (AF - 3))
≧ 100 - (84 + 6 / (5.35 - 3))
≧ **13.4 %**

SM test = (Nmin - Nc.1) / Nmin
=(7218 - 4731) / 7218
= **34.5 %**

(Min.Speed = 7218 rpm)

INSPECTION TEAM
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PK to PK

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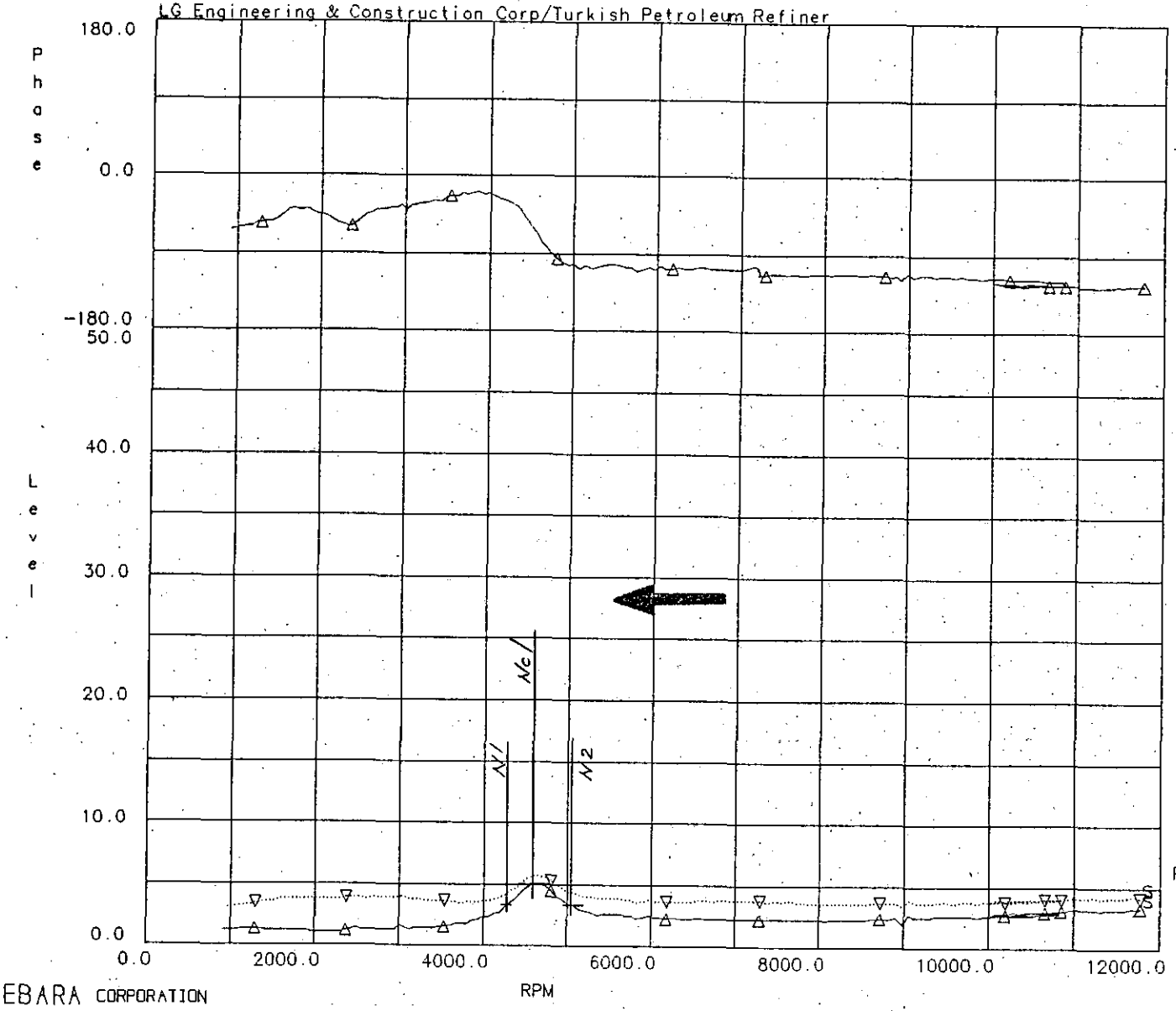
R0215708
25MB5

SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



AF = Nc.1 / (N2-N1)
= 4579 / (5044 - 4269)
= **5.91**

SM ≧ 100 - (84 + 6 / (AF - 3))
≧ 100 - (84 + 6 / (5.91 - 3))
≧ **13.9 %**

SM test = (Nmin - Nc.1) / Nmin
=(7218 - 4579) / 7218
= **36.6 %**

(Min.Speed = 7218 rpm)

PK to PK

INSPECTION TEAM
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EBARA CORPORATION

Wed Oct 1 17:16:02 2003

3 Record for Turbine

3-1 Running Test Record

Period		
9:58	to 18:51	Normal Mechanical Running Test
11:38	to 11:53	Over Speed Running
12:00	to 16:00	4hours Running at MCS
		*Bearing Performance Test
13:24	to 13:39	Lube Oil Supply Temp. = 43 ℃
		Lube Oil Supply Press. = 1.27kg/cm2G
14:06	to 14:21	Lube Oil Supply Temp. = 49 ℃
		Lube Oil Supply Press. = 1.05kg/cm2G
17:15	to 18:51	Unbalance Verification Test

蒸気タービン運転記録

52

STEAM TURBINE RUNNING TEST RECORD (1/3)

PAGE : 1

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	TC-9901	R0215708	SRV-5DF

回転方向（蒸気入口側から見て） DIRECTION OF ROTATION (facing STEAM end) : 時計 CW

ロータ ROTOR : A A

起動 START 9:58 停止 STOP 18:51

時刻 TIME	回転数 SPEED min⁻¹	軸振動 SHAFT VIBRATION (μm p-p) カップリング側 CP END CH. NO 14	CH. NO 13	反カップリング側 OCP END CH. NO 12	CH. NO 11	軸移動量 1 AXIAL DISP.1 mm	軸移動量 2 AXIAL DISP.2 mm	主蒸気圧 INLET STEAM PRESS. kgf/cm²G	排気圧 EXHAUST STEAM PRESS. kgf/cm²G	シール蒸気圧 主蒸気側 SEAL STEAM INLET SIDE kgf/cm²G	グランドリーク圧 GRAND LEAK PRESS. kgf/cm²G		
9:58	0	------	------	------	------	-0.13	-0.14	31.4	-0.61	-0.45	-0.32		
10:05	19	------	------	------	------	-0.12	-0.13	36.1	-0.86	-0.56	-0.37		
10:24	1093	4.3	4.6	2.1	2.1	-0.05	-0.06	34.0	-0.88	0.32	-0.14		
10:42	2996	4.8	4.8	2.3	3.5	-0.03	-0.04	32.0	-0.87	0.21	-0.20		
10:57	7212	4.9	4.7	3.6	4.6	-0.05	-0.06	34.6	-0.88	0.20	-0.20		
11:07	10833	7.6	5.1	4.3	4.8	-0.07	-0.08	30.6	-0.87	0.23	-0.21		
11:16	7217	5.0	4.8	2.3	2.1	-0.05	-0.05	35.3	-0.88	0.22	-0.19		
11:20	8121	4.8	4.3	2.5	2.2	-0.05	-0.06	34.4	-0.88	0.23	-0.19		
11:23	9021	6.1	4.8	2.7	2.9	-0.05	-0.06	31.9	-0.88	0.23	-0.20		
11:27	9925	6.3	5.2	3.1	3.5	-0.06	-0.07	30.0	-0.88	0.22	-0.21		
11:29	10828	8.4	5.3	4.3	4.8	-0.07	-0.09	29.5	-0.87	0.24	-0.17		
11:38	11791	13.3	5.9	8.3	9.2	-0.07	-0.09	28.3	-0.88	0.21	-0.14		
11:53	11793	13.6	6.4	8.3	9.2	-0.09	-0.09	30.7	-0.88	0.20	-0.14		
12:00	10826	9.0	5.3	5.1	5.8	-0.07	-0.09	31.7	-0.88	0.22	-0.14		
12:15	10828	8.8	5.1	5.6	6.6	-0.06	-0.08	30.7	-0.88	0.21	-0.14		
12:30	10825	8.7	5.2	5.2	6.4	-0.07	-0.09	32.0	-0.88	0.21	-0.13		
12:45	10828	9.1	5.3	5.3	6.6	-0.07	-0.09	32.8	-0.87	0.22	-0.13		

一次危険速度 FIRST CRITICAL SPEED	3996 min⁻¹
蒸気気密性 STEAM TIGHTNESS	合格 ACCEPTABLE
外部油漏れ OUTWARD OIL LEAKAGE	合格 NO LEAK
手動トリップテスト HAND TRIP TEST	合格 ACCEPTABLE
遠隔トリップテスト REMOTE TRIP TEST	合格 ACCEPTABLE

調速機試験 GOVERNOR TEST

速度範囲 SPEED RANGE 7218 ～ 10828 min⁻¹

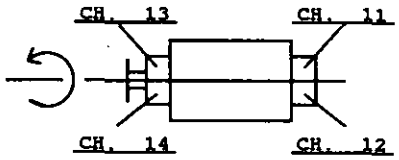
試験結果 合格 ACCEPTABLE

テスト TRIAL NO.	1	2	3
過速度トリップテスト OVERSPEED TRIP TEST (min⁻¹)	11910		

規定値 11911 min⁻¹ ± 1% (11792 ～ 12030 min⁻¹)

[記事 NOTES]

1. 油 OIL : ISO VG#32
2. タービン軸中心と油圧力計との高さの差
   Differential head between the turbine centerline and the oil pressure gauge = 0.00 m, 0.00 kgf/cm²G
3. 軸振動計器番号 上から見て
   Vibration channel No. ---- plan view.



LG E&C INSPECTION TEAM ☑ WITNESSED ☐ REVIEWED

御立会者 WITNESSED BY 日付 DATE

/ /

審査 TEST ENGINEER 日付 DATE

N.ISHIKAWA 03/10/01

記録 RECORDED BY 日付 DATE

T.NISHIYAMA 03/10/01

蒸気タービン運転記録

STEAM TURBINE RUNNING TEST RECORD (1/3)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	TC-9901	R0215708	SRV-5DF

回転方向（蒸気入口側から見て） DIRECTION OF ROTATION (facing STEAM end) : 時計 CW

ロータ ROTOR : A A

起動 START 9:58 停止 STOP 18:51

時刻 TIME	回転数 SPEED min⁻¹	軸振動 SHAFT VIBRATION (μm p-p) カップリング側 CP END CH. NO 14	CH. NO 13	反カップリング側 OCP END CH. NO 12	CH. NO 11	軸移動量 1 AXIAL DISP.1 mm	軸移動量 2 AXIAL DISP.2 mm	主蒸気圧 INLET STEAM PRESS. kgf/cm²G	排気圧 EXHAUST STEAM PRESS. kgf/cm²G	シール蒸気圧 主蒸気側 SEAL STEAM INLET SIDE kgf/cm²G	グランドリーク圧 GRAND LEAK PRESS. kgf/cm²G		
13:00	10827	9.2	5.4	5.3	6.5	-0.07	-0.09	31.3	-0.88	0.21	-0.13		
13:15	10827	7.2	4.9	4.1	5.5	-0.07	-0.09	32.0	-0.87	0.21	-0.13		
13:24	10825	7.5	5.0	4.3	5.7	-0.07	-0.08	31.9	-0.88	0.21	-0.13		
13:30	10825	7.4	5.0	4.1	5.6	-0.06	-0.08	33.4	-0.88	0.22	-0.12		
13:39	10828	7.5	5.0	4.1	5.5	-0.07	-0.08	33.2	-0.88	0.22	-0.12		
13:45	10827	8.6	5.2	4.8	6.1	-0.06	-0.08	32.3	-0.88	0.21	-0.12		
14:00	10825	10.4	5.8	5.9	6.4	-0.06	-0.07	32.8	-0.88	0.22	-0.12		
14:06	10828	10.4	5.7	6.0	6.7	-0.06	-0.07	32.8	-0.87	0.22	-0.12		
14:15	10824	10.4	5.7	6.2	6.9	-0.06	-0.08	33.4	-0.88	0.22	-0.12		
14:21	10827	10.3	5.7	6.1	6.8	-0.07	-0.08	32.0	-0.87	0.22	-0.12		
14:30	10826	8.5	5.2	5.0	5.9	-0.06	-0.08	31.3	-0.87	0.21	-0.13		
14:45	10829	8.7	5.2	5.1	6.0	-0.06	-0.08	33.3	-0.88	0.23	-0.12		
15:00	10829	8.7	5.2	5.0	5.9	-0.06	-0.07	31.2	-0.87	0.22	-0.13		
15:15	10827	8.5	5.2	4.8	5.6	-0.06	-0.08	32.7	-0.88	0.22	-0.12		
15:30	10826	8.7	5.3	5.0	5.8	-0.07	-0.08	32.5	-0.88	0.22	-0.12		
15:45	10826	8.7	5.3	4.9	5.8	-0.06	-0.08	31.4	-0.88	0.22	-0.12		
16:00	10825	8.7	5.3	5.0	5.9	-0.06	-0.07	33.2	-0.87	0.21	-0.12		
16:06	9925	6.3	4.7	3.6	3.7	-0.06	-0.07	31.2	-0.87	0.21	-0.12		
16:08	9027	5.3	4.8	2.9	2.6	-0.04	-0.06	33.6	-0.87	0.21	-0.12		
16:11	8118	4.8	4.2	3.0	3.1	-0.05	-0.06	29.9	-0.87	0.21	-0.12		
16:15	7219	4.9	4.6	2.9	3.1	-0.03	-0.06	26.8	-0.87	0.21	-0.13		
16:25	0	------	------	------	------	0.06	0.05	0.1	-0.86	0.16	-0.20		
17:15	0	------	------	------	------	0.09	0.07	29.7	-0.85	0.17	-0.17		

INSPECTION TEAM
☑ WITNESSED ☐ REVIEWED
LG E&C

御立会者 WITNESSED BY 日付 DATE

/ /

審査 TEST ENGINEER 日付 DATE

N.ISHIKAWA H. Ishikawa 03/10/01

記録 RECORDED BY 日付 DATE

T.NISHIYAMA T. Nishiyama 03/10/01

蒸気タービン運転記録

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STEAM TURBINE RUNNING TEST RECORD (1/3)

PAGE : 3

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	TC-9901	R0215708	SRV-5DF

回転方向（蒸気入口側から見て） DIRECTION OF ROTATION (facing STEAM end) : 時計 CW

ロータ ROTOR : A A

起動 START 9:58 停止 STOP 18:51

時刻 TIME	回転数 SPEED min⁻¹	軸振動 SHAFT VIBRATION (μm p-p) カップリング側 CP END CH. NO 14	CH. NO 13	反カップリング側 OCP END CH. NO 12	CH. NO 11	軸移動量1 AXIAL DISP.1 mm	軸移動量2 AXIAL DISP.2 mm	主蒸気圧 INLET STEAM PRESS. kgf/cm²G	排気圧 EXHAUST STEAM PRESS. kgf/cm²G	シール蒸気圧 主蒸気側 SEAL STEAM INLET SIDE kgf/cm²G	グランドリーク圧 GRAND LEAK PRESS. kgf/cm²G		
17:30	1230	4.1	4.5	2.0	2.1	-0.05	-0.07	35.1	-0.87	0.20	-0.12		
17:44	2380	4.2	4.2	1.6	2.0	-0.03	-0.05	37.6	-0.87	0.20	-0.13		
17:52	7217	6.6	6.1	3.4	4.3	-0.06	-0.07	35.3	-0.87	0.19	-0.14		
18:04	10824	21.3	16.5	2.5	2.2	-0.07	-0.08	31.6	-0.87	0.20	-0.15		
18:21	11778	22.4	20.2	6.3	4.0	-0.07	-0.09	29.1	-0.87	0.20	-0.16		
18:33	10825	19.7	14.6	4.9	2.4	-0.07	-0.09	29.2	-0.87	0.19	-0.16		
18:42	7120	8.5	7.0	3.6	3.6	-0.04	-0.05	24.0	-0.87	0.19	-0.16		
18:51	0	------	------	------	------	0.03	0.02	0.2	-0.86	0.14	-0.21		

LG E&G INSPECTION TEAM ☑ WITNESSED ☐ REVIEWED Oct. 1, 03

御立会者 WITNESSED BY 日付 DATE / /

審査 TEST ENGINEER 日付 DATE

N.ISHIKAWA 03/10/01

記録 RECORDED BY 日付 DATE

T.NISHIYAMA 03/10/01

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

蒸気タービン運転記録

STEAM TURBINE RUNNING TEST RECORD (2/3)

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	TC-9901	R0215708	SRV-5DF

回転方向（蒸気入口側から見て） DIRECTION OF ROTATION (facing STEAM end) : 時計 CW	ロータ ROTOR : A A	起動 START 9:58	停止 STOP 18:51

時刻 TIME	回転数 SPEED min⁻¹	軸受給油圧 LUBE OIL PRESS. kgf/cm²G	コントロール油給油圧 CONTROL OIL PRESS. kgf/cm²G	軸受給油温度 LUBE OIL INLET TEMP ℃	軸受戻り油温度 高圧側 LUBE DRAIN TEMP. (HP SIDE) ℃	軸受戻り油温度 低圧側 LUBE DRAIN TEMP. (LP SIDE) ℃	軸受戻り油温度 スラスト LUBE DRAIN TEMP. (TH SIDE) ℃	主蒸気温度 INLET STEAM TEMP. ℃	シール蒸気温度 SEAL STEAM TEMP. ℃	排気温度 EXHAUST STEAM TEMP. ℃			
9:58	0	1.18	8.98	45.0	44.8	44.0	45.2	242.9	87.1	25.5			
10:05	19	1.17	8.32	45.1	44.9	44.1	45.3	245.0	78.8	24.7			
10:24	1093	1.17	8.27	45.3	45.8	44.4	45.8	241.8	140.4	48.7			
10:42	2996	1.13	8.20	45.3	48.2	46.0	47.3	239.6	141.9	50.1			
10:57	7212	1.12	8.18	45.2	56.7	54.6	53.1	243.3	141.7	49.8			
11:07	10833	1.11	8.15	45.5	68.9	67.4	59.3	240.0	142.1	59.4			
11:16	7217	1.11	8.16	45.5	57.5	58.9	53.5	244.8	141.8	58.4			
11:20	8121	1.12	8.15	45.4	59.4	59.5	54.8	245.1	142.5	57.6			
11:23	9021	1.12	8.14	45.4	61.8	61.0	56.2	247.0	142.5	57.1			
11:27	9925	1.12	8.13	45.4	65.1	64.3	57.8	250.7	142.2	60.0			
11:29	10828	1.13	8.16	45.3	68.3	67.1	59.2	252.9	142.5	61.2			
11:38	11791	1.12	8.11	45.6	72.9	72.6	61.2	259.9	142.4	64.6			
11:53	11793	1.12	8.09	45.4	73.1	74.3	61.0	271.5	142.9	68.7			
12:00	10826	1.12	8.06	45.5	69.1	70.6	59.3	272.1	142.8	69.0			
12:15	10828	1.11	8.02	45.4	69.0	70.1	59.1	275.6	142.5	70.8			
12:30	10825	1.12	7.99	45.2	68.9	70.0	59.0	278.1	142.9	73.4			
12:45	10828	1.12	7.97	45.2	68.9	70.1	59.1	278.7	143.3	76.1			

INSPECTION TEAM
☑ WITNESSED ☐ REVIEWED
LG E&C

御立会者 WITNESSED BY 日付 DATE

/ /

審査 TEST ENGINEER 日付 DATE

N.ISHIKAWA 03/10/01

記録 RECORDED BY 日付 DATE

T.NISHIYAMA T. Nishiyama 03/10/01

蒸気タービン運転記録

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STEAM TURBINE RUNNING TEST RECORD (2/3)

PAGE : 2

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	TC-9901	R0215708	SRV-5DF

回転方向（蒸気入口側から見て） DIRECTION OF ROTATION (facing STEAM end) : 時計 CW　　ロータ ROTOR : A　　起動 START 9:58　　停止 STOP 18:51

時刻 TIME	回転数 SPEED min⁻¹	軸受給油圧 LUBE OIL PRESS. kgf/cm²G	コントロール油 給油圧 CONTROL OIL PRESS. kgf/cm²G	軸受給油温度 LUBE OIL INLET TEMP ℃	軸受戻り油温度 高圧側 LUBE DRAIN TEMP. (HP SIDE) ℃	軸受戻り油温度 低圧側 LUBE DRAIN TEMP. (LP SIDE) ℃	軸受戻り油温度 スラスト LUBE DRAIN TEMP. (TH SIDE) ℃	主蒸気温度 INLET STEAM TEMP. ℃	シール蒸気温度 SEAL STEAM TEMP. ℃	排気温度 EXHAUST STEAM TEMP. ℃			
13:00	10827	1.12	7.93	45.5	69.1	70.1	59.2	280.6	143.0	78.4			
13:15	10827	1.29	7.95	42.3	65.4	67.7	56.4	281.2	142.8	78.4			
13:24	10825	1.27	7.92	42.9	65.9	67.9	56.9	281.6	142.7	78.8			
13:30	10825	1.26	7.91	42.7	65.6	67.6	56.7	282.8	142.9	79.3			
13:39	10828	1.28	7.90	42.5	65.5	67.6	56.6	281.8	143.3	79.9			
13:45	10827	1.18	7.84	45.7	68.2	69.0	58.4	281.6	142.9	80.5			
14:00	10825	1.06	7.77	48.7	72.1	72.6	61.7	281.1	143.4	81.9			
14:06	10828	1.07	7.75	49.1	72.5	73.0	62.0	281.2	143.2	83.0			
14:15	10824	1.06	7.72	49.7	73.0	73.6	62.4	281.4	142.9	83.5			
14:21	10827	1.06	7.73	49.7	73.0	73.6	62.3	281.4	143.0	83.5			
14:30	10826	1.19	7.76	45.7	68.9	70.3	59.3	280.4	142.9	83.2			
14:45	10829	1.17	7.72	45.7	68.9	70.0	59.2	280.8	143.1	83.4			
15:00	10829	1.17	7.69	45.6	68.7	69.9	59.1	281.0	142.8	83.8			
15:15	10827	1.18	7.73	45.5	68.6	69.8	59.1	279.7	143.3	83.8			
15:30	10826	1.18	7.69	45.7	68.8	69.9	59.2	279.9	142.8	84.2			
15:45	10826	1.17	7.68	45.6	68.7	69.8	59.1	279.4	143.2	84.4			
16:00	10825	1.17	7.65	45.5	68.7	69.8	59.1	280.6	143.0	84.6			
16:06	9925	1.17	7.63	45.6	65.9	67.9	57.7	279.8	142.8	86.9			
16:08	9027	1.17	7.61	45.6	63.2	65.6	56.4	277.9	143.0	87.1			
16:11	8118	1.17	7.61	45.6	60.5	62.6	54.8	275.9	142.8	85.9			
16:15	7219	1.18	7.62	45.6	57.7	59.7	53.3	272.0	143.0	83.3			
16:25	0	1.22	8.17	45.7	46.4	47.5	46.1	235.9	141.5	70.1			
17:15	0	1.22	7.64	45.6	46.1	45.6	45.7	238.5	142.2	62.2			

INSPECTION TEAM
☑ WITNESSED ☐ REVIEWED
LG E&C

御立会者 WITNESSED BY　　日付 DATE

/ /

審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA　　03/10/01

記録 RECORDED BY　　日付 DATE

T.NISHIYAMA　　03/10/01

蒸気タービン運転記録

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STEAM TURBINE RUNNING TEST RECORD (2/3)

PAGE : 3

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	TC-9901	R0215708	SRV-5DF

回転方向（蒸気入口側から見て） DIRECTION OF ROTATION (facing STEAM end) : 時計 CW　　ロータ ROTOR : A　　起動 START 9:58　　停止 STOP 18:51

時刻 TIME	回転数 SPEED min⁻¹	軸受給油圧 LUBE OIL PRESS. kgf/cm²G	コントロール油給油圧 CONTROL OIL PRESS. kgf/cm²G	軸受給油温度 LUBE OIL INLET TEMP ℃	軸受戻り油温度 高圧側 LUBE DRAIN TEMP. (HP SIDE) ℃	軸受戻り油温度 低圧側 LUBE DRAIN TEMP. (LP SIDE) ℃	軸受戻り油温度 スラスト LUBE DRAIN TEMP. (TH SIDE) ℃	主蒸気温度 INLET STEAM TEMP. ℃	シール蒸気温度 SEAL STEAM TEMP. ℃	排気温度 EXHAUST STEAM TEMP. ℃			
17:30	1230	1.24	7.66	45.6	46.7	45.9	46.0	242.9	142.7	64.3			
17:44	2380	1.22	7.67	45.6	48.1	46.8	46.8	246.9	143.0	62.7			
17:52	7217	1.17	7.66	45.6	57.0	54.3	53.1	250.3	142.4	65.2			
18:04	10824	1.16	7.66	45.6	68.5	67.4	59.0	259.3	143.2	70.0			
18:21	11778	1.17	7.70	45.7	72.8	73.5	60.8	266.8	143.1	73.5			
18:33	10825	1.17	7.67	45.6	68.7	69.8	59.1	270.6	142.7	73.9			
18:42	7120	1.18	7.62	45.7	57.6	59.2	53.4	263.0	142.3	71.0			
18:51	0	1.22	8.26	45.7	46.6	47.5	46.0	232.5	141.8	61.8			

LG E&C　INSPECTION TEAM ☑ WITNESSED ☐ REVIEWED

御立会者 WITNESSED BY　　日付 DATE

/ /

審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA　N. Ishikawa　03/10/01

記録 RECORDED BY　　日付 DATE

T.NISHIYAMA　T. Nishiyama　03/10/01

蒸気タービン運転記録

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STEAM TURBINE RUNNING TEST RECORD (3/3)

PAGE : 1

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	TC-9901	R0215708	SRV-5DF

回転方向（蒸気入口側から見て） DIRECTION OF ROTATION (facing STEAM end) : 時計 CW	ロータ ROTOR : A A	起動 START 9:58	停止 STOP 18:51

時刻 TIME	回転数 SPEED min^{-1}	ジャーナル軸受温度 高圧側 JNL.BRG TEMP. (HP SIDE) ℃	ジャーナル軸受温度 高圧側 JNL.BRG TEMP. (HP SIDE) ℃	ジャーナル軸受温度 低圧側 JNL.BRG TEMP. (LP SIDE) ℃	ジャーナル軸受温度 低圧側 JNL.BRG TEMP. (LP SIDE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 反負荷側 THRUST. BRG TEMP. (INACTIVE) ℃	スラスト軸受温度 反負荷側 THRUST. BRG TEMP. (INACTIVE) ℃			
9:58	0	44.6	45.0	45.6	45.6	45.2	45.1	45.0	45.1	45.2			
10:05	19	44.8	45.2	45.8	45.8	45.3	45.3	45.2	45.4	45.3			
10:24	1093	50.6	51.0	51.6	52.0	48.1	47.3	47.8	46.3	46.0			
10:42	2996	62.5	59.4	63.4	63.0	50.5	49.4	49.7	47.7	47.3			
10:57	7212	84.0	65.9	85.3	81.6	55.6	55.2	55.7	52.1	51.4			
11:07	10833	96.7	76.4	99.2	96.3	62.0	62.1	62.4	57.1	55.4			
11:16	7217	82.9	65.5	83.5	82.2	54.2	55.2	55.0	52.4	51.9			
11:20	8121	87.1	67.1	87.7	85.6	56.0	56.8	56.6	53.7	52.9			
11:23	9021	90.9	68.7	91.4	89.2	57.6	58.4	58.0	54.8	53.8			
11:27	9925	95.1	71.8	95.0	92.8	59.2	59.8	59.5	56.1	54.7			
11:29	10828	96.5	76.3	98.4	96.0	61.1	61.4	61.4	57.2	55.4			
11:38	11791	97.7	80.5	101.4	99.1	63.2	63.7	63.6	59.0	57.0			
11:53	11793	97.0	80.2	101.0	98.8	62.1	62.8	62.5	58.9	56.8			
12:00	10826	95.5	76.2	97.5	96.3	59.8	60.7	60.1	57.8	56.2			
12:15	10828	95.4	76.1	97.7	96.4	59.4	60.4	59.9	57.8	56.2			
12:30	10825	95.5	76.2	97.6	96.2	59.2	60.4	59.7	57.7	56.1			
12:45	10828	95.3	75.8	97.7	96.2	59.4	60.2	59.6	57.8	56.3			

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御立会者 WITNESSED BY 日付 DATE

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審査 TEST ENGINEER 日付 DATE

N.ISHIKAWA 03/10/01

記録 RECORDED BY 日付 DATE

T.NISHIYAMA 03/10/01

蒸気タービン運転記録

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STEAM TURBINE RUNNING TEST RECORD (3/3)

PAGE : 2

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	TC-9901	R0215708	SRV-5DF

回転方向（蒸気入口側から見て） DIRECTION OF ROTATION (facing STEAM end) : 時計 CW　　ロータ ROTOR : A A　　起動 START 9:58　　停止 STOP 18:51

時刻 TIME	回転数 SPEED min⁻¹	ジャーナル軸受温度 高圧側 JNL.BRG TEMP. (HP SIDE) ℃	ジャーナル軸受温度 高圧側 JNL.BRG TEMP. (HP SIDE) ℃	ジャーナル軸受温度 低圧側 JNL.BRG TEMP. (LP SIDE) ℃	ジャーナル軸受温度 低圧側 JNL.BRG TEMP. (LP SIDE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 負荷側 THRUST. BRG TEMP. (ACTIVE) ℃	スラスト軸受温度 反負荷側 THRUST. BRG TEMP. (INACTIVE) ℃	スラスト軸受温度 反負荷側 THRUST. BRG TEMP. (INACTIVE) ℃			
13:00	10827	95.3	75.7	97.6	96.2	59.2	60.3	59.5	58.0	56.5			
13:15	10827	96.7	70.4	97.0	95.3	56.3	57.6	56.6	55.3	53.8			
13:24	10825	96.5	71.2	97.2	95.5	56.9	58.4	57.2	55.9	54.3			
13:30	10825	96.7	71.2	97.3	95.4	56.6	58.0	57.1	55.7	54.1			
13:39	10828	96.7	70.8	97.3	95.3	56.6	57.9	56.9	55.6	54.0			
13:45	10827	95.9	74.9	98.3	96.6	58.2	59.5	58.7	57.2	55.6			
14:00	10825	95.5	79.0	98.1	97.2	61.7	62.6	62.0	60.4	58.8			
14:06	10828	95.6	79.2	98.1	97.3	62.1	62.9	62.2	60.7	59.2			
14:15	10824	95.6	79.9	98.8	96.9	62.4	63.3	62.6	61.0	59.7			
14:21	10827	95.6	79.6	98.8	96.7	62.2	63.2	62.5	61.0	59.6			
14:30	10826	95.2	75.4	97.4	96.1	59.1	60.1	59.2	57.9	56.5			
14:45	10829	95.2	75.1	97.6	96.1	59.0	60.1	59.2	57.8	56.5			
15:00	10829	95.2	75.5	97.7	96.0	59.0	60.0	59.1	57.7	56.4			
15:15	10827	95.2	75.0	97.7	96.0	58.9	59.9	59.1	57.7	56.2			
15:30	10826	95.2	75.0	97.6	96.1	59.1	60.1	59.3	57.9	56.4			
15:45	10826	95.3	75.0	97.6	96.1	59.1	60.1	59.3	57.9	56.4			
16:00	10825	95.3	75.0	97.7	96.2	58.9	59.9	59.2	57.7	56.2			
16:06	9925	93.4	71.6	94.2	93.0	57.5	58.7	57.6	56.4	55.4			
16:08	9027	90.4	68.5	91.1	90.0	56.1	57.4	56.3	55.2	54.7			
16:11	8118	86.6	66.6	87.4	85.9	54.4	55.7	54.9	54.0	53.6			
16:15	7219	82.2	65.1	83.0	82.2	53.0	54.2	53.6	52.8	52.6			
16:25	0	48.1	49.3	48.8	49.3	46.2	46.1	46.2	46.1	46.4			
17:15	0	46.5	47.7	46.8	47.2	45.5	45.6	45.5	45.6	45.8			

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審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA　　03/10/01

記録 RECORDED BY　　日付 DATE

T.NISHIYAMA　　03/10/01

蒸気タービン運転記録

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STEAM TURBINE RUNNING TEST RECORD (3/3)

PAGE : 3

顧客名 CUSTOMER	アイテム No. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp Turkish Petroleum Refineries Corp	TC-9901	R0215708	SRV-5DF

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17:30	1230	52.2	52.4	52.9	53.4	47.2	47.0	47.5	46.7	46.6			
17:44	2380	59.5	56.7	60.2	60.1	48.3	48.2	48.8	47.4	47.1			
17:52	7217	83.7	64.8	85.2	81.1	54.4	55.0	54.9	52.3	51.8			
18:04	10824	96.5	75.1	97.2	95.7	60.7	61.0	60.7	57.1	55.4			
18:21	11778	97.4	79.2	100.4	98.1	62.2	62.5	62.2	58.7	56.5			
18:33	10825	95.8	75.4	96.8	95.6	59.6	60.2	59.6	57.5	56.0			
18:42	7120	82.4	65.3	82.3	81.4	53.5	54.3	53.8	52.6	52.5			
18:51	0	48.0	49.0	48.6	49.1	46.0	46.0	46.1	46.0	46.3			

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審査 TEST ENGINEER　　日付 DATE

N.ISHIKAWA　　03/10/01

記録 RECORDED BY　　日付 DATE

T.NISHIYAMA　　03/10/01

3 Record for Turbine

3-2 Vibration Amplitude Record

a Bode Plot of Start up

[Note]

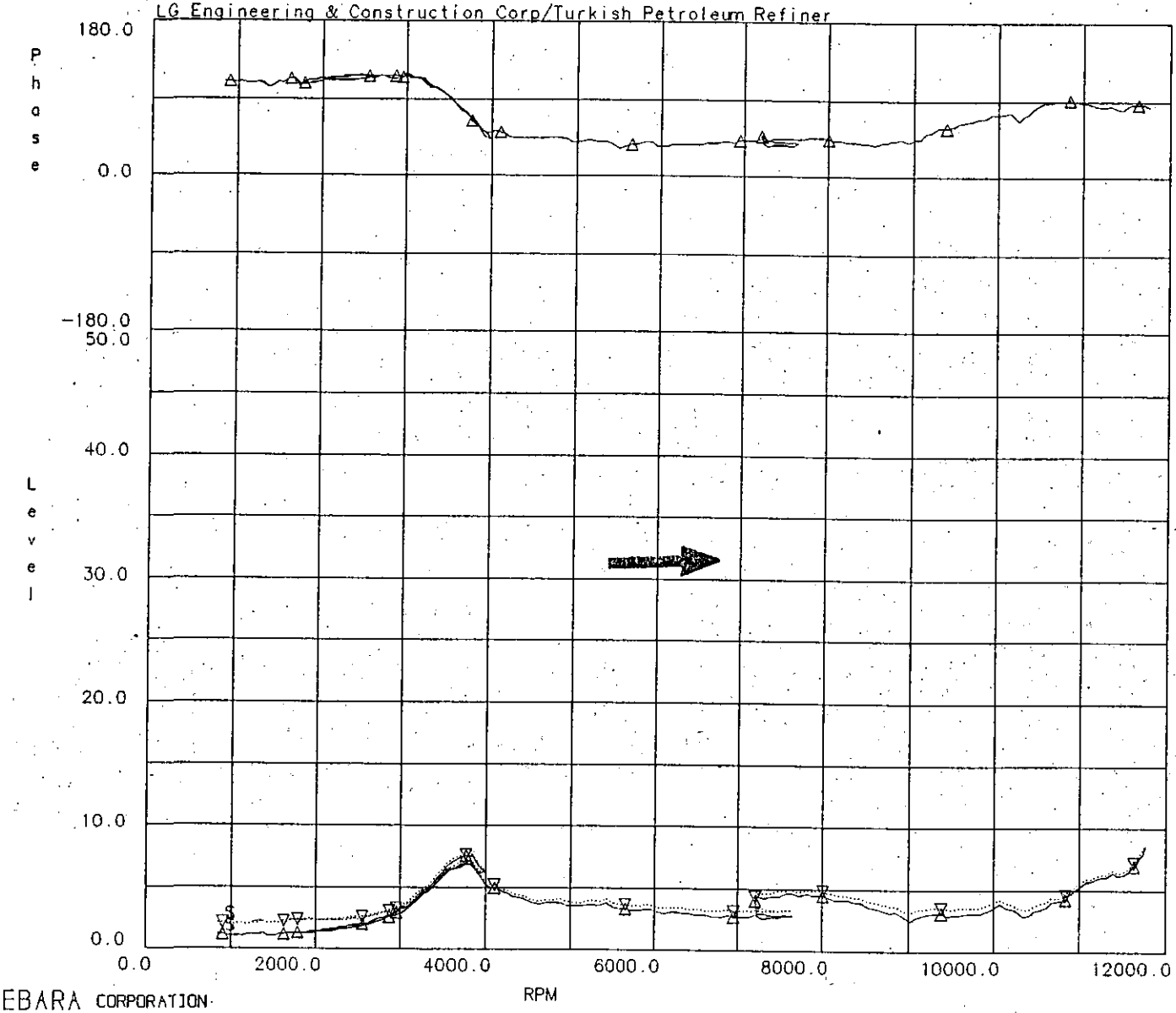
T.SE.X	:	Steam End X
T.SE.Y	:	Steam End Y
T.EE.X	:	Exhaust End X
T.EE.Y	:	Exhaust End Y

EO : 1.0	:	Synchronous Frequency
TOTAL	:	Overall
Unit	.	Vibration : μ m p-p
.	.	Phase : Degree
.	.	.

R0215708
25MB5

SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



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EBARA CORPORATION

Wed Oct 1 10:05:49 2003

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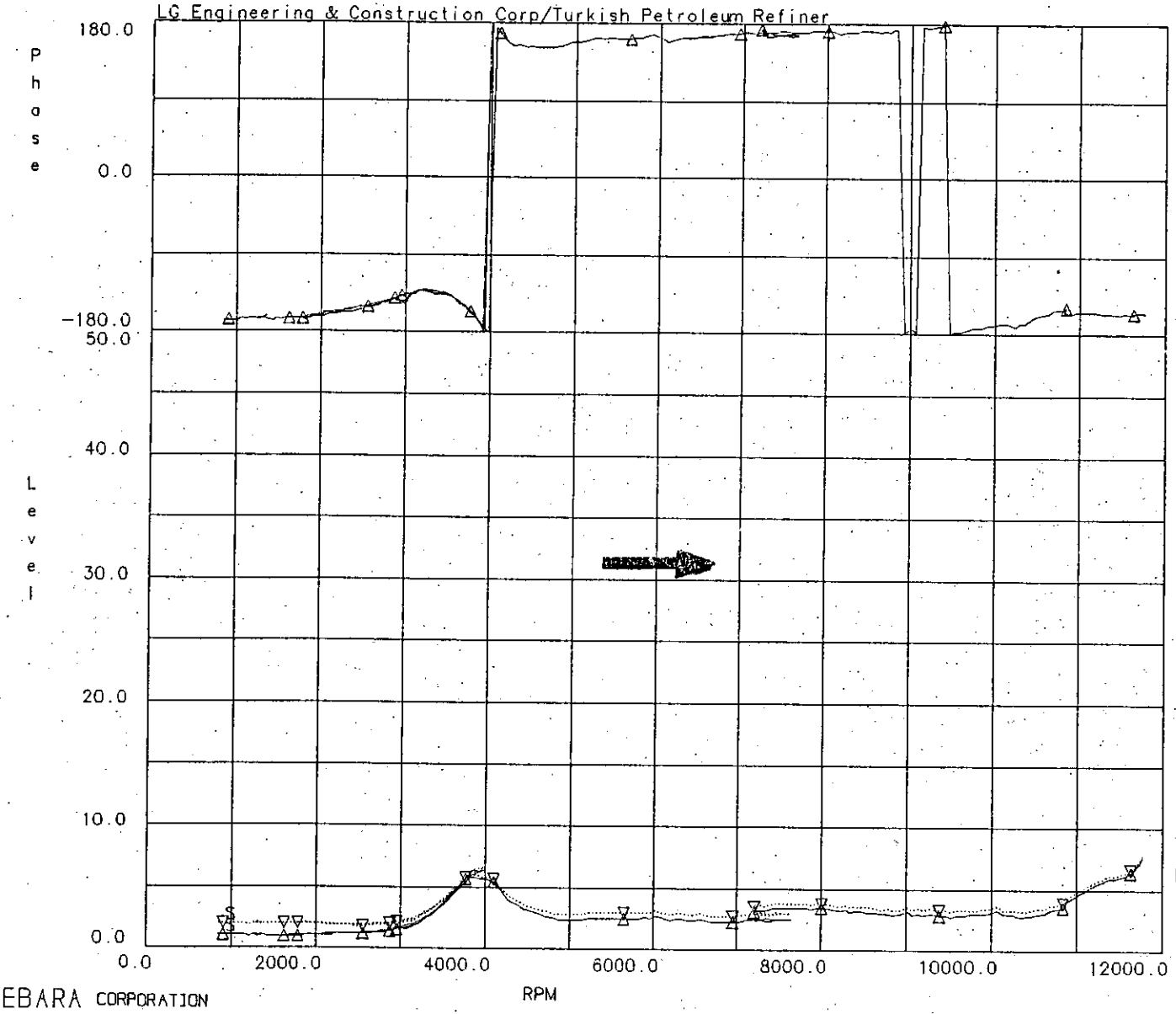
R0215708
25MB5

SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



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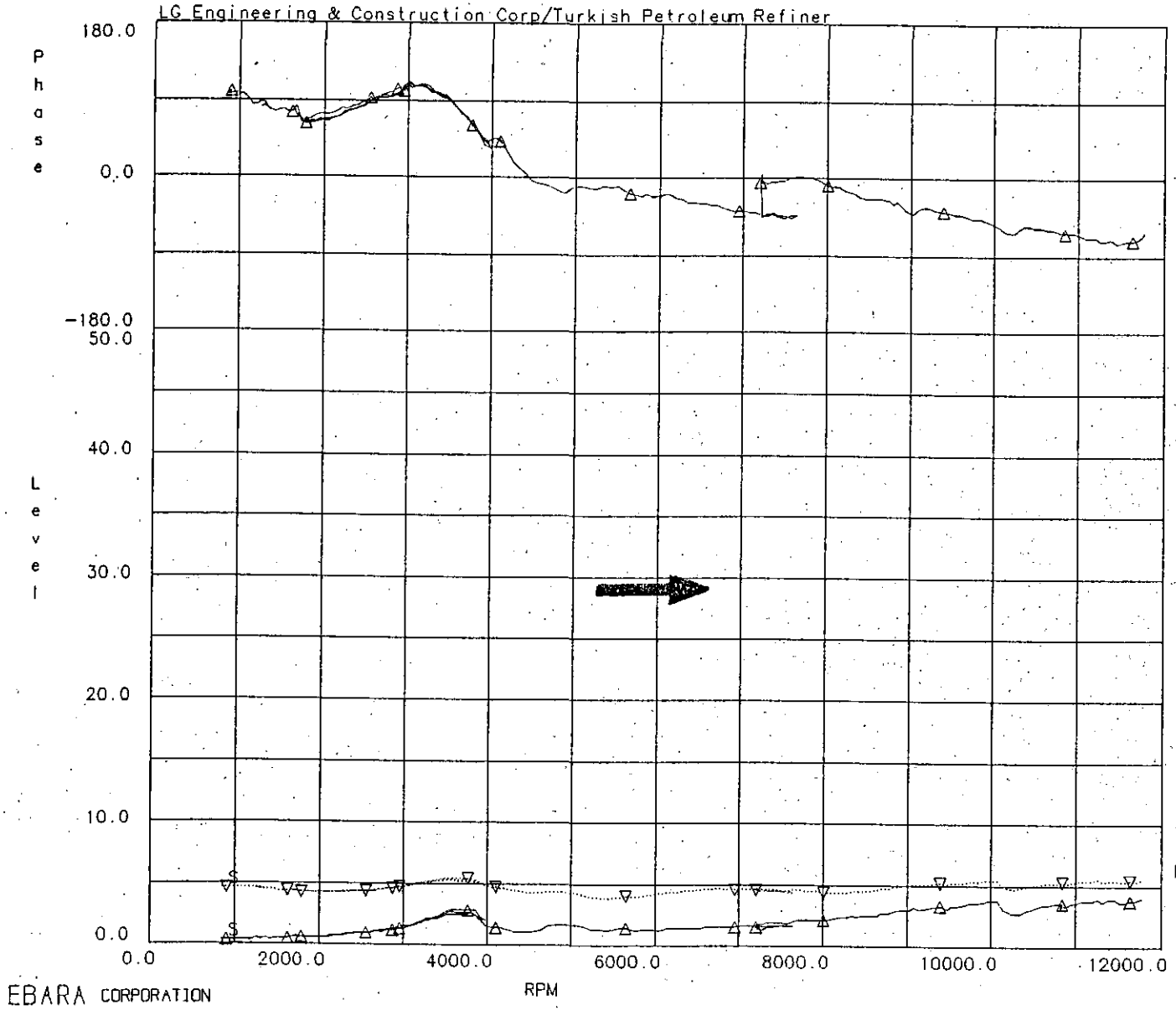

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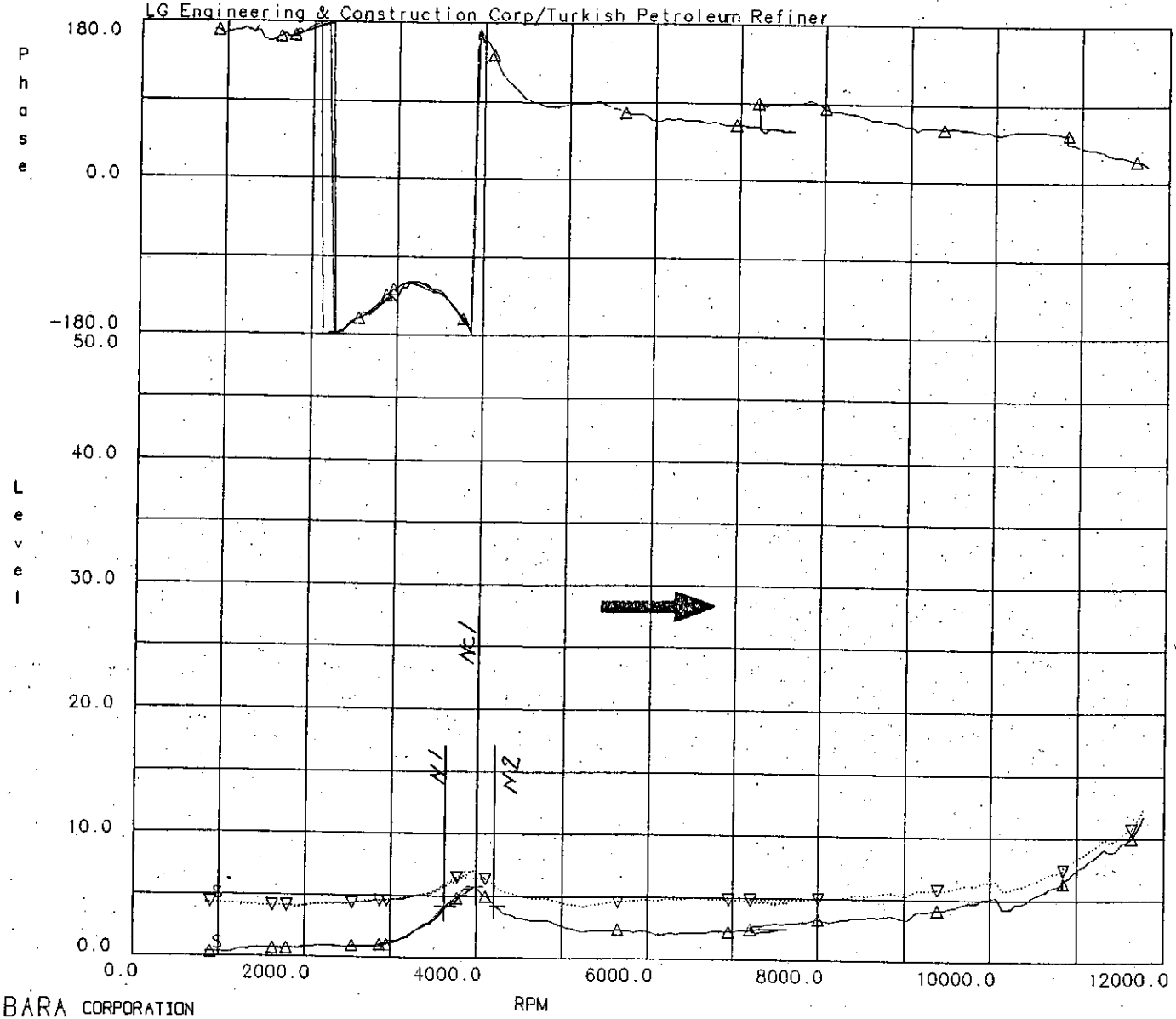

△ T.EE.Y EO: 1.0
▽ T.EE.Y TOTAL

AF = Nc.1 / (N2-N1)
= 3996 / (4210 - 3640)
= **7.01**

SM ≧ 100 - (84 + 6 / (AF - 3))
≧ 100 - (84 + 6 / (7.01 - 3))
≧ **14.5 %**

SM test = (Nmin - Nc.1) / Nmin
=(7218 - 3996) / 7218
= **44.6 %**

(Min.Speed = 7218 rpm)

PK to PK

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3 Record for Turbine

3-2 Vibration Amplitude Record

b Bode Plot of Coast Down

[Note]

T.SE.X	:	Steam End X
T.SE.Y	:	Steam End Y
T.EE.X	:	Exhaust End X
T.EE.Y	:	Exhaust End Y

EO : 1.0	:	Synchronous Frequency
TOTAL	:	Overall
Unit	.	Vibration : μm p-p
.	.	Phase : Degree
.	.	.

R0215708
25MB5

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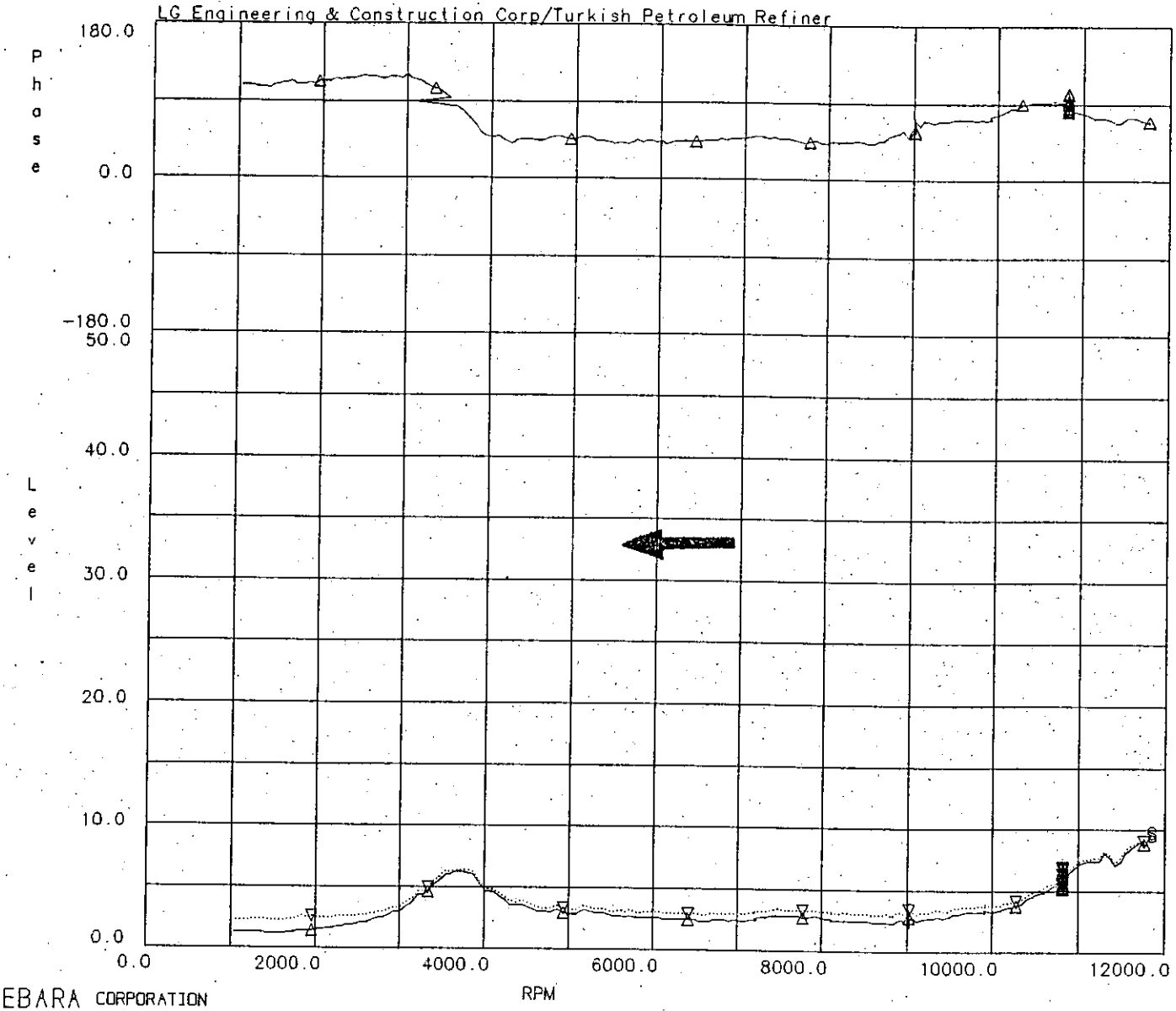
LG Engineering & Construction Corp/Turkish Petroleum Refiner



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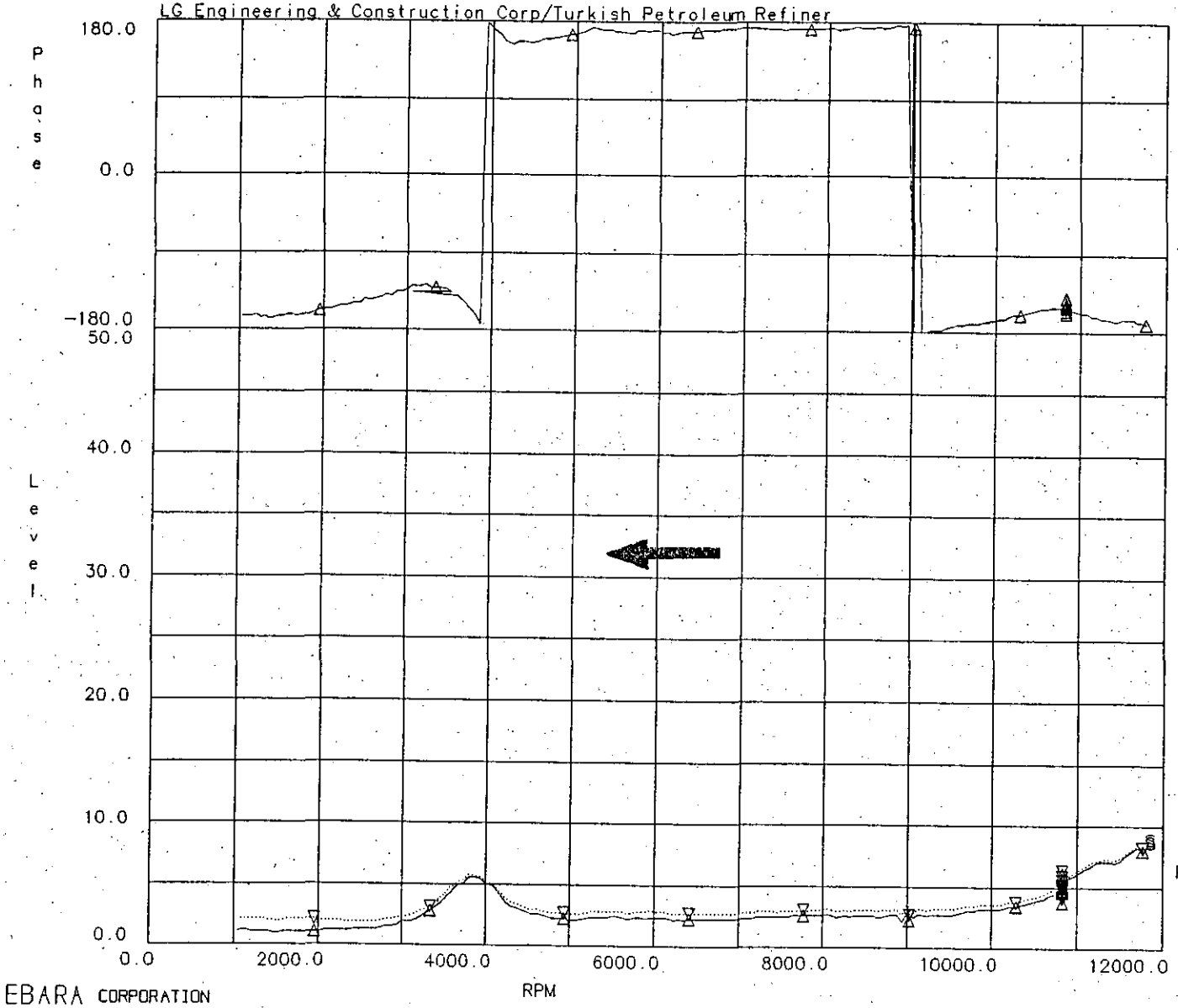

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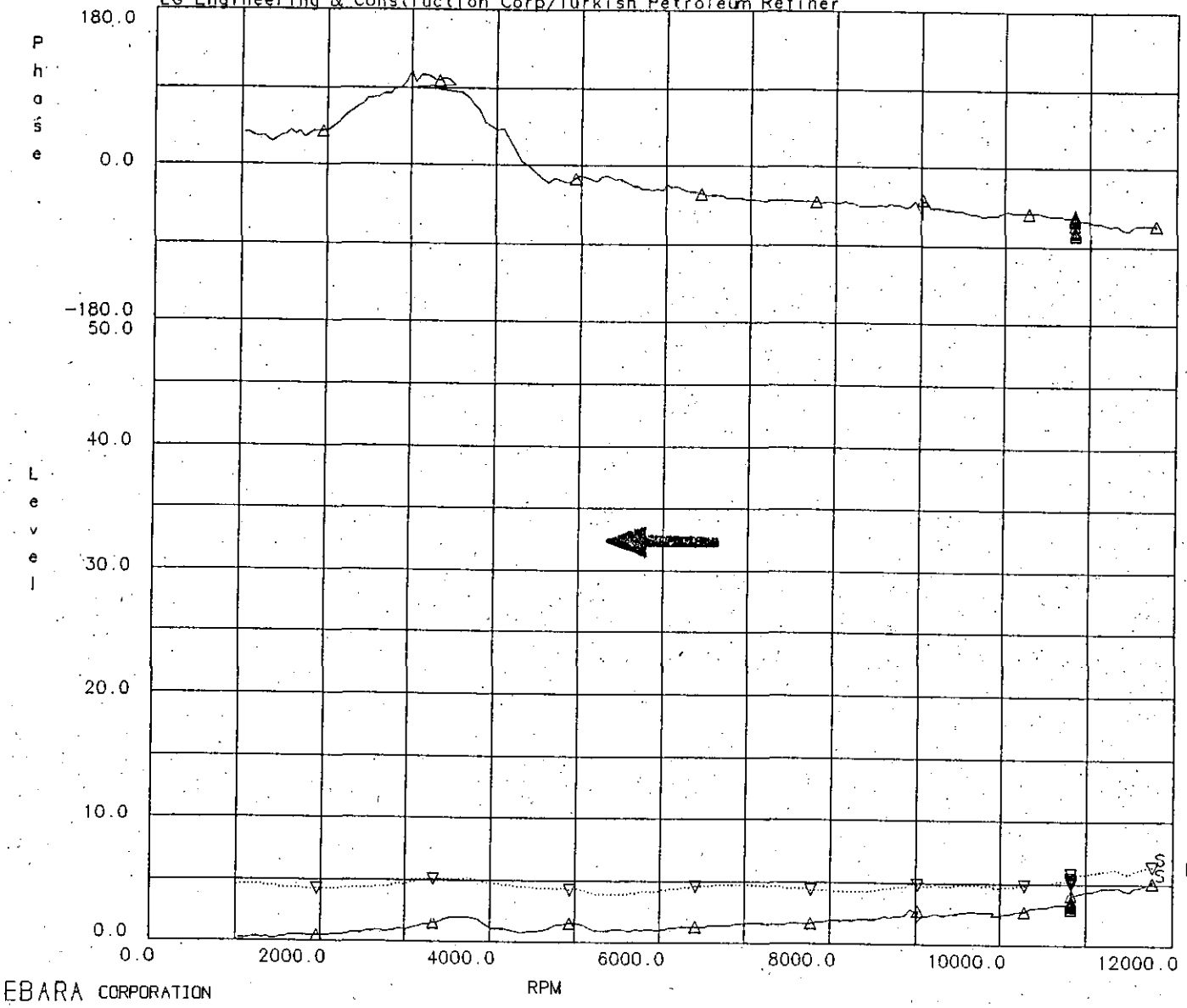

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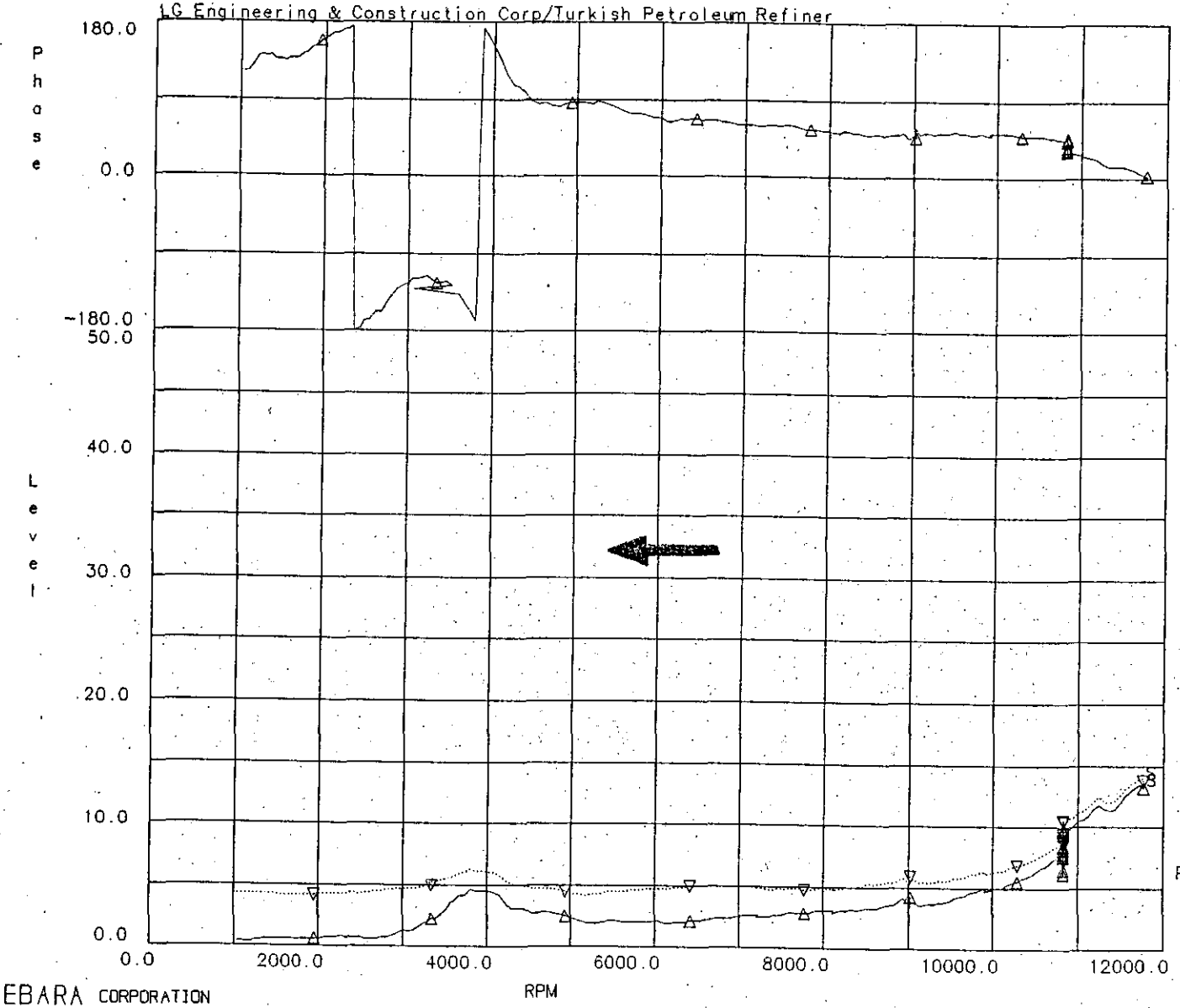

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EBARA CORPORATION

Wed Oct 1 10:05:49 2003

3 Record for Turbine

3-3 Vibration Sweep Record

at MCS

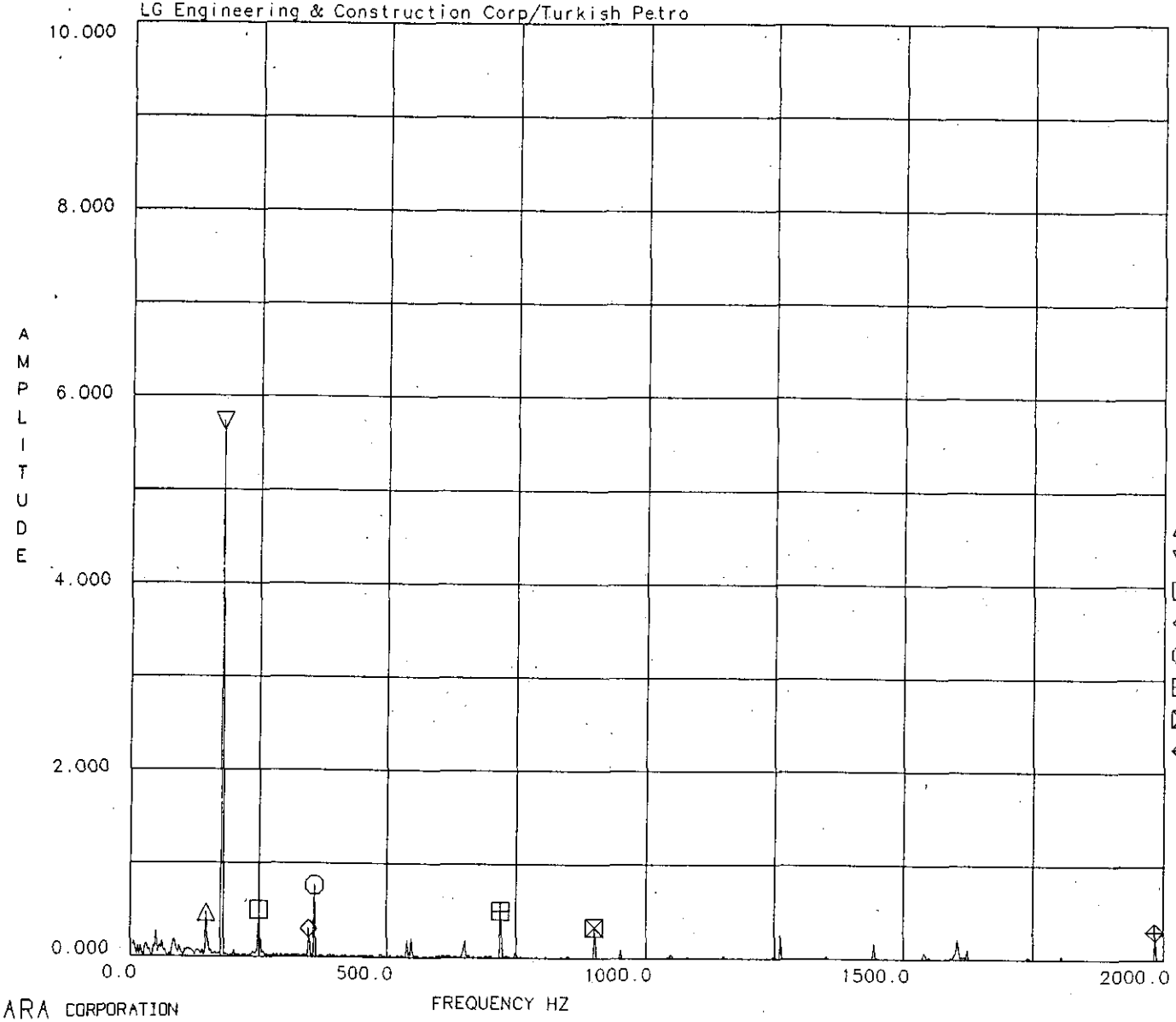
[Note]

T.SE.X	:	Steam End X
T.SE.Y	:	Steam End X
T.EE.X	:	Exhaust End X
T.EE.Y	:	Exhaust End Y

unit : μm p-p

R0215708
25MB5

SRV-5DF
LG Engineering & Construction Corp/Turkish Petro



T.SE.X

P-P

N1 rpm10827
TIME 15:35:01

	FREQ	AMP
△	149	0.479
▽	180	5.739
□	251	0.504
◇	350	0.298
○	361	0.770
⊞	722	0.508
⊠	902	0.331
⊕	1985	0.302

Overall 5.98

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INSPECTION TEAM
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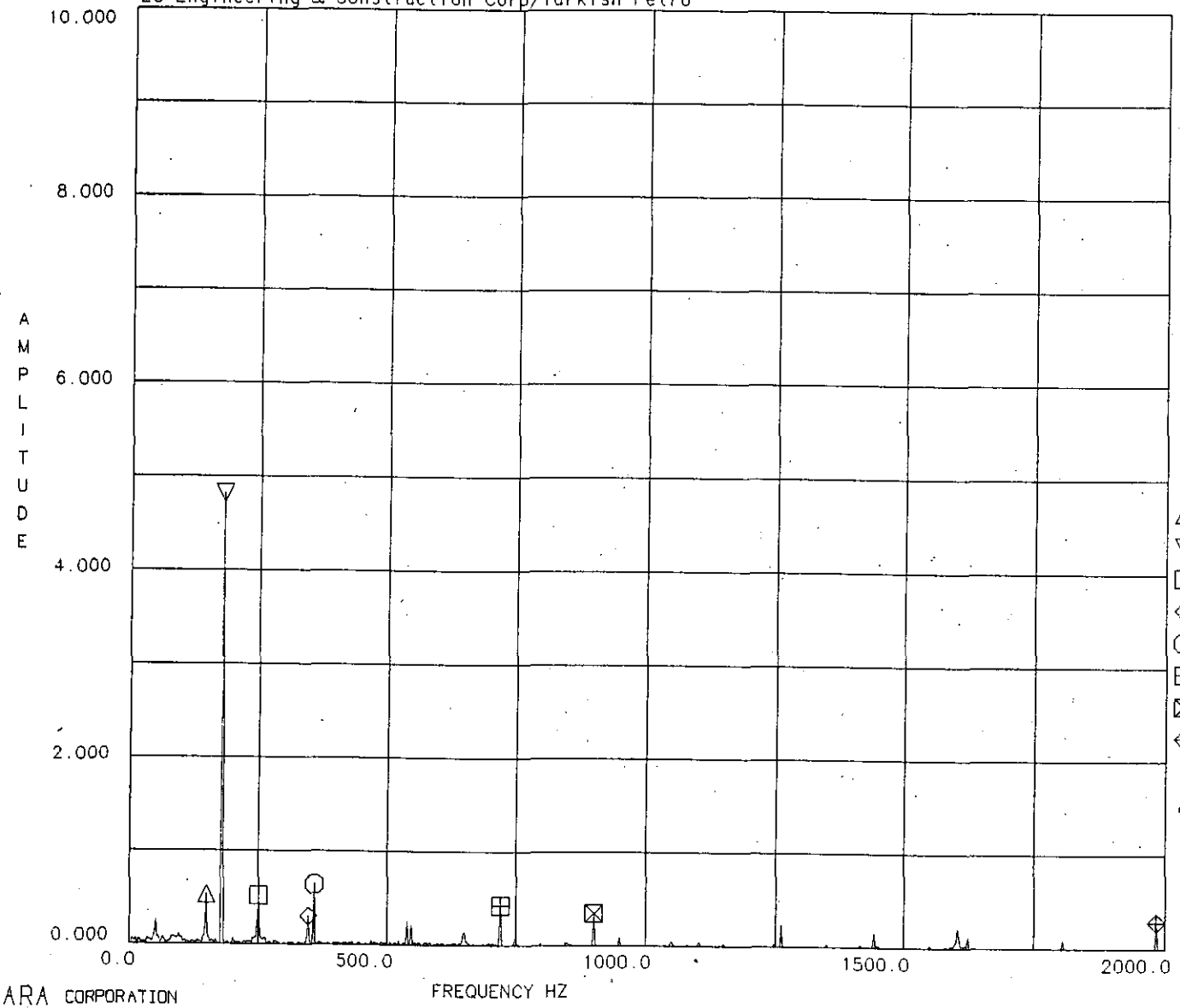
LG Engineering & Construction Corp/Turkish Petro



T.SE.Y

P-P

N1 rpm10827
TIME 15:35:01

	FREQ	AMP
△	149	0.533
▽	180	4.813
□	251	0.520
◇	350	0.304
○	361	0.653
⊞	722	0.426
⊠	902	0.358
⊕	1985	0.296

Overall 5.05

INSPECTION TEAM
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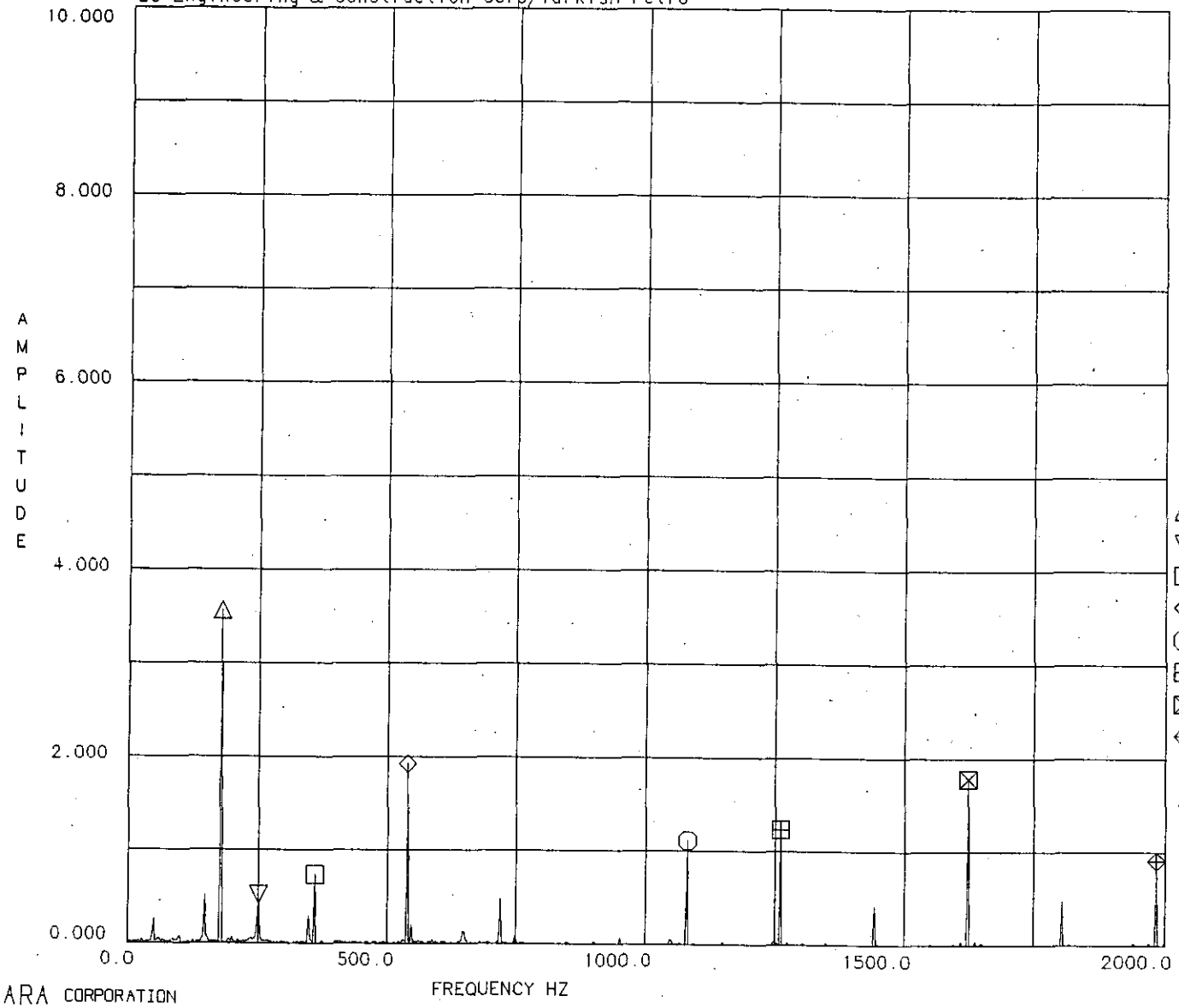
LG Engineering & Construction Corp/Turkish Petro



T.EE.X

P-P

N1 rpm10827
TIME 15:35:01

	FREQ	AMP
△	180	3.563
▽	251	0.522
□	361	0.750
◇	541	1.924
○	1083	1.111
⊞	1263	1.236
⊠	1624	1.783
⊕	1985	0.916

Overall 5.05

INSPECTION TEAM
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Wed Oct 1 10:05:49 2003

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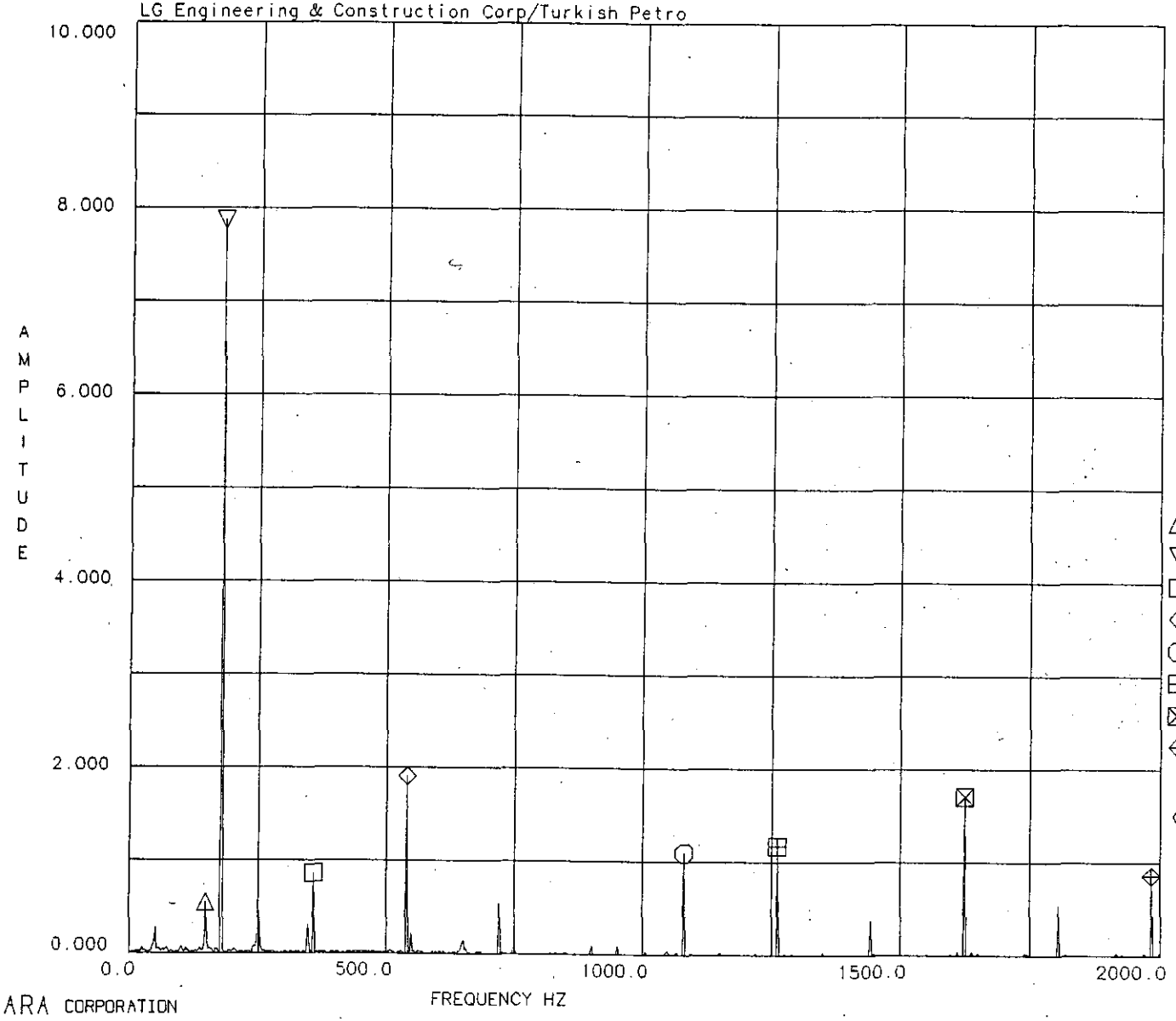
LG Engineering & Construction Corp/Turkish Petro



T.EE.Y

P-P

N1 rpm 0827
TIME 15:35:01

	FREQ	AMP
△	149	0.560
▽	180	7.886
□	361	0.870
◇	541	1.912
○	1083	1.101
⊞	1263	1.187
⊠	1624	1.717
⊕	1985	0.865

Overall 8.66

LG E&C

INSPECTION TEAM
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EBARA CORPORATION

Wed Oct 1 10:05:49 2003

3 Record for Turbine

3-4 Unbalance Verification Test Record

a Specification

SPECIFICATIONS

Shop Order : R021570803
Frame Size : SRV-5DF

Design Data

: Minimum Continuous Speed	7218	[RPM]	
: Design Speed	10312	[RPM]	
: Maximum Continuous Speed	10828	[RPM]	— MCS
: Over Speed	11911	[RPM]	-- OVS
: Shaft Overhung Weight	24.1	[kgf]	

Coupling Data

	Exhaust End		Steam End
: Manufacture	Eagle Industry		-
: Size	4.5		-
: Half Coupling Weight	40.0	[kgf]	-
: Length Between Shaft End	800	[mm]	-

Placed Unbalance

: Amounts	598.000	[g-mm]
: Location	Coupling	

Definition of Amounts of Unbalance(oz-in)

$$U = U_{cplg} + U_{shaft}$$

$$U_{cplg} = \mathrm{Max}\left[\frac{40\ W_{cplg}}{N},\ 0.008\ W_{cplg},\ 0.1\right]$$

$$U_{shaft} = 8\frac{4\ W_{shaft}}{N}$$

where : W_{cplg} = Coupling Half Weight
W_{shaft} = Shaft Overhung Weight (Exclude W_{cplg})
N = Maximum Continuous Speed

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2-4 Unbalance Verification Test Specification for Turbine

a Specification

S.O. No : R021570803
Model : SRV-5DF
Item No : TC-9901

TABLE 1
SEAL CLEARANCE VS AMPLITUDE
UNBALANCE AT COUPLING Major Axis (μm p-p)

STATION NO.	SEAL DESCRIPTION	ASS'Y CLEALANCE	75% CLEALANCE	Nc1	MCS	OVS
10	EE OIL SEAL	318.0	238.5	1.03	8.31	9.69
13	EE GLND OUTER	780.0	585.0	0.54	6.86	8.23
14	EE GLND MIDDLE	780.0	585.0	0.32	6.09	7.41
15	EE GLND INNER	780.0	585.0	0.44	5.49	6.77
18	5TH DIAF PKN	780.0	585.0	0.85	4.10	5.25
20	5TH TIP SEAL	2940.0	2205.0	1.00	3.57	4.65
24	5TH TIP SEAL	2940.0	2205.0	1.77	0.59	0.89
26	5TH DIAF PKN	780.0	585.0	1.84	0.85	0.95
29	4TH TIP SEAL	2940.0	2205.0	1.99	2.00	2.28
31	4TH DIAF PKN	780.0	585.0	2.02	2.34	2.70
33	3RD TIP SEAL	1269.0	945.0	2.04	2.97	3.54
35	3RD DIAF PKN	780.0	585.0	2.04	3.20	3.84
37	2ND TIP SEAL	1260.0	945.0	0.53	3.63	4.43
39	2ND DIAF PKN	780.0	585.0	1.97	3.78	4.64
43	1ST TIP SEAL	1260.0	945.0	1.90	4.02	4.98
45	SE GLND INNER	780.0	585.0	1.79	4.21	5.25
46	SE GLND MIDDLE	780.0	585.0	1.68	4.27	5.33
47	SE GLND OUTER	780.0	585.0	1.55	4.24	5.31
48	SE OIL SEAL	780.0	585.0	1.42	4.18	5.22
53	SE OIL SEAL	368.0	276.0	1.03	4.13	5.25

TABLE 2
AMPLITUDE AT THE PROBES
UNBALANCE AT COUPLING Major Axis (μm p-p)

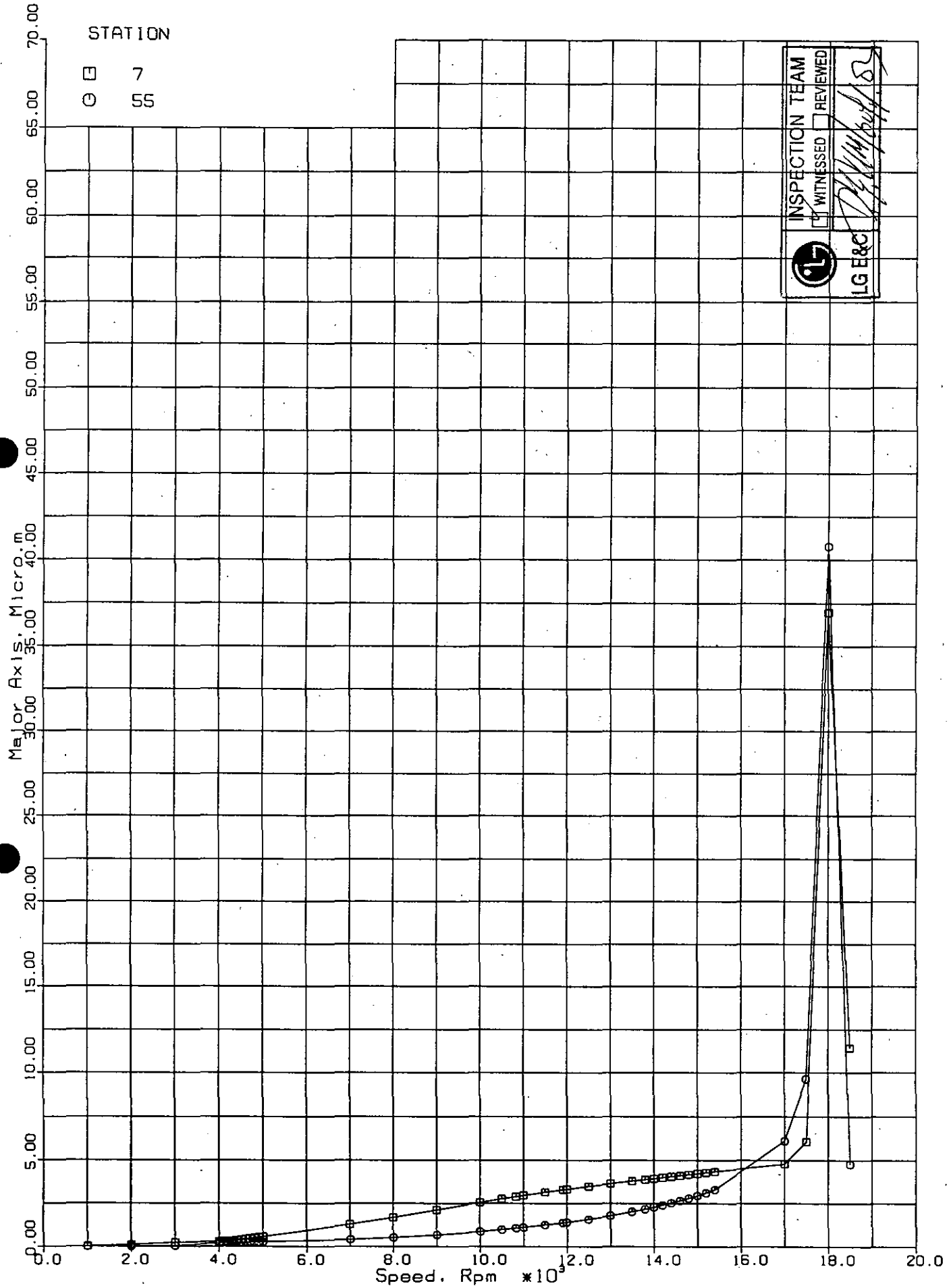
		Nc1	MCS	OVS
DRIVE END	Major Axis	-	10.92	12.44
	Horizontal	-	9.38	10.88
	Vartical	-	10.82	12.40
FREE END	Major Axis	-	4.05	5.25
	Horizontal	-	3.30	4.34
	Vartical	-	3.74	4.96

LG E&C INSPECTION TEAM ☑ WITNESSED ☐ REVIEWED

3 Record for Turbine

3-4 Unbalance Verification Test Record

b Test Results



LC/TUPRAS SRV-5DF

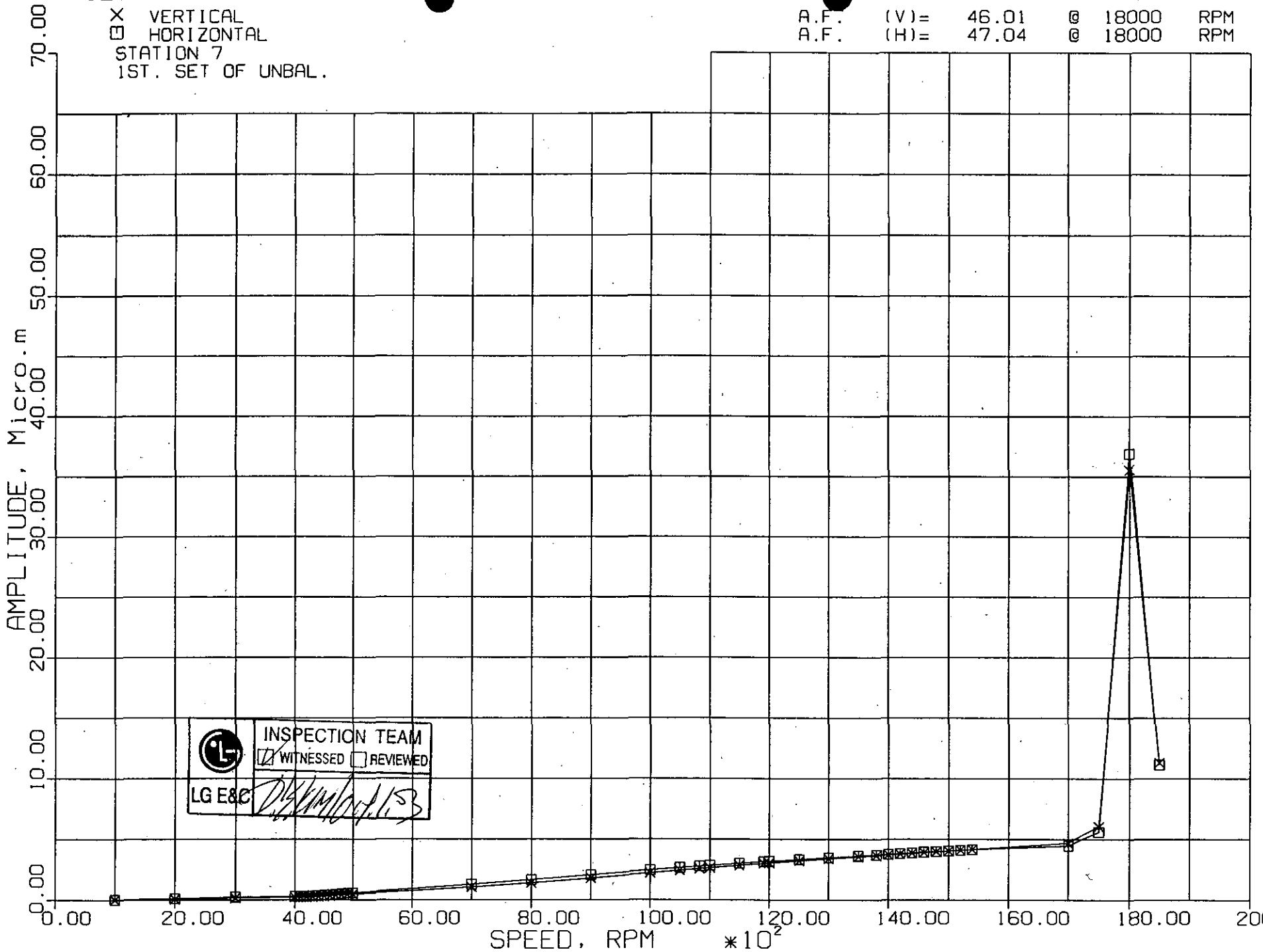
RO21570803

1ST. SET OF UNBAL.

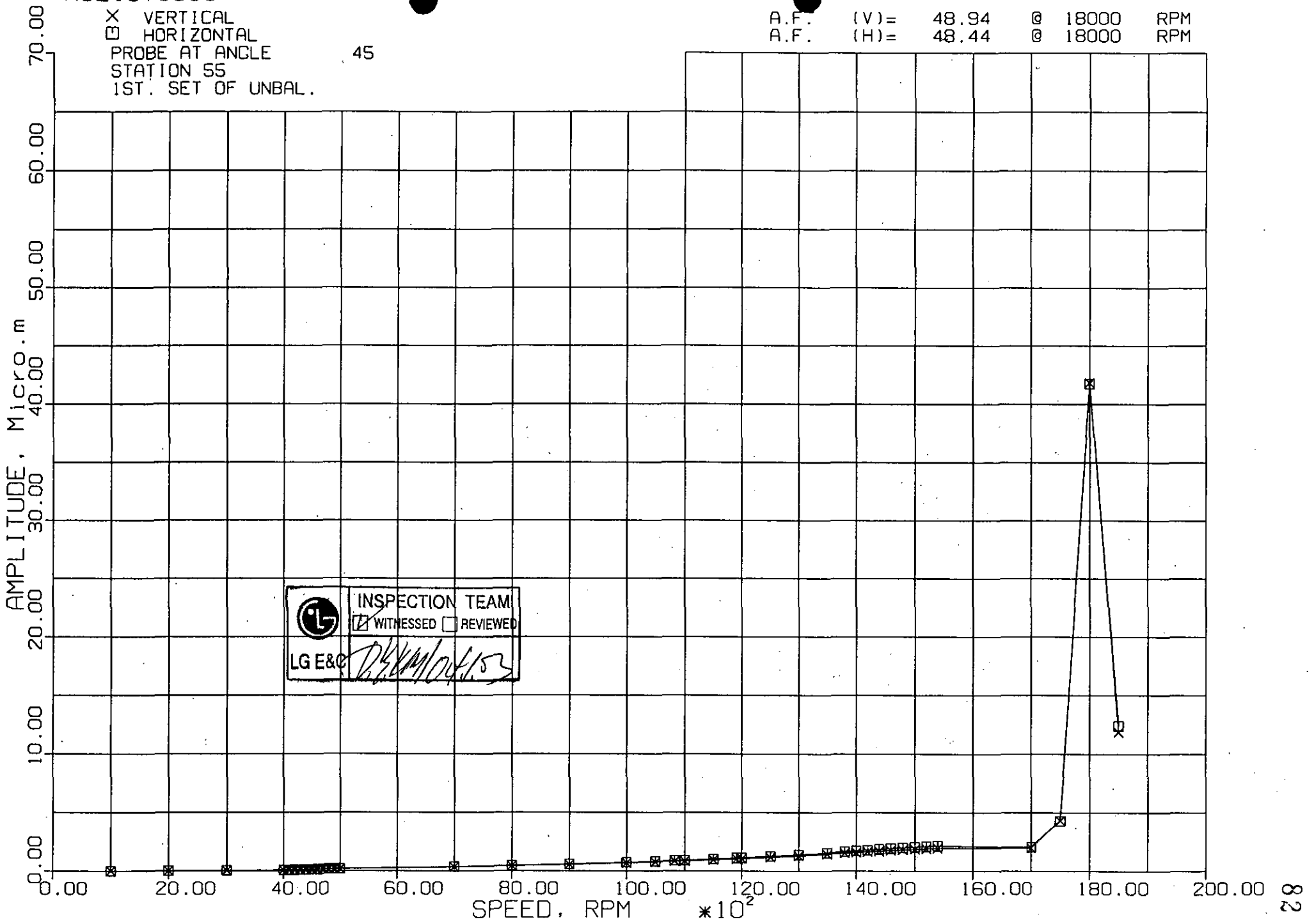
LC/TUPRAS SRV-5DF
R021570803

× VERTICAL
□ HORIZONTAL
STATION 7
1ST. SET OF UNBAL.

A.F. (V)= 46.01 @ 18000 RPM
A.F. (H)= 47.04 @ 18000 RPM



INSPECTION TEAM
☑ WITNESSED ☐ REVIEWED
LG E&C


LC/TUPRAS SRV-5DF
R021570803
X VERTICAL
□ HORIZONTAL
PROBE AT ANGLE 45
STATION 55
1ST. SET OF UNBAL.
A.F. (V)= 48.94 @ 18000 RPM
A.F. (H)= 48.44 @ 18000 RPM
AMPLITUDE, Micro.m
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
200.00
SPEED, RPM *10²
INSPECTION TEAM
WITNESSED REVIEWED
LG E&C

SO No. : R021570803
Model : SRV-5DF
Item No : TC-9901
Rotor : A (Spare)

3-4 Unbalance Verification Test Result for Turbine (at MCS)

Verification test was conducted after the mechanical running test. The unbalance weight was installed on drive end coupling hub. Amounts was determined by 8 X Umax.
The value of the placed unbalance are as follows.

PLACED UNBALANCE LOCATION	AMOUNTS (g-mm)	P.C.D.of cplg bolt (mm)	unbalance weight (g)
COUPLING HUB	598.0	204.8	5.84

MEASURED VALUE (at MCS)

MODEL	Item No :	TC-9901	Item No :	TC-9901
PROBE LOCATION	NDE X	NDE Y	DE X	DE Y
MEASURED VIBRATION (μm p-p) RUN WITHOUT WEIGHT	6.04	5.26	4.02	9.37
MEASURED VIBRATION (μm p-p) RUN WITH UNBALANCE WEIGHT	2.66	5.38	14.58	20.35
MEASURED PHASE (deg) RUN WITHOUT WEIGHT	82.91	-154.07	-59.48	33.39
MEASURED PHASE (deg) RUN WITH UNBALANCE WEIGHT	-9.29	133.87	-101.40	-22.71
OBTAINED VECTOR CHANGE (μm p-p) (MEASURED)	6.69	6.26	11.90	17.01
CALCULATED AMPLITUDE WITH UNBALANCE WEIGHT (μm p-p)	3.30	3.74	9.38	10.82
RATIO ALONG WITH ANALYTICAL VALUE	2.03	1.67	1.27	1.57

RESULT

MAXIMUM VIBRATION AMPLITUDE
ITS CALCULATED BY ABOVE TEST RESULT

SEAL DESCRIPTION	AMPLITUDE (μm p-p MAJOR AXIS)	75% CLEARANCE DIA.(μm p-p)
10 OIL SEAL	16.9	238.5

LG E&C
INSPECTION TEAM
☑ WITNESSED ☐ REVIEWED

Acceptable

This description has the most severe clearance, and the calculated value of the vibration is less than 75% minimum clearance.

Oct 3 '03

SO No. : R021570803
Model : SRV-5DF
Item No : TC-9901
Rotor : A (Spare)

3-4 Unbalance Verification Test Result for Turbine (at OVS)

Verification test was conducted after the mechanical running test. The unbalance weight was installed on drive end coupling hub. Amounts was determined by 8 X Umax.
The value of the placed unbalance are as follows.

PLACED UNBALANCE LOCATION	AMOUNTS (g-mm)	P.C.D.of cplg bolt (mm)	unbalance weight (g)
COUPLING HUB	598.0	204.8	5.84

MEASURED VALUE (at OVS)

MODEL	Item No :	TC-9901	Item No :	TC-9901
PROBE LOCATION	NDE X	NDE Y	DE X	DE Y
MEASURED VIBRATION (μm p-p) RUN WITHOUT WEIGHT	9.06	8.27	5.28	13.47
MEASURED VIBRATION (μm p-p) RUN WITH UNBALANCE WEIGHT	3.70	6.16	20.01	22.44
MEASURED PHASE (deg) RUN WITHOUT WEIGHT	69.16	-168.25	-64.96	3.60
MEASURED PHASE (deg) RUN WITH UNBALANCE WEIGHT	-71.40	91.93	-110.31	-40.44
OBTAINED VECTOR CHANGE (μm p-p) [MEASURED]	12.14	11.12	16.72	15.83
CALCULATED AMPLITUDE WITH UNBALANCE WEIGHT (μm p-p)	4.34	4.96	10.88	12.40
RATIO ALONG WITH ANALYTICAL VALUE	2.80	2.24	1.54	1.28

RESULT

MAXIMUM VIBRATION AMPLITUDE
ITS CALCULATED BY ABOVE TEST RESULT

SEAL DESCRIPTION	AMPLITUDE (μm p-p MAJOR AXIS)	75% CLEARANCE DIA.(μm p-p)
10 OIL SEAL	27.1	238.5

LG E&C — INSPECTION TEAM ☑ WITNESSED ☐ REVIEWED

Acceptable

This description has the most severe clearance, and the calculated value of the vibration is less than 75% minimum clearance.

H. Ishibashi Oct 3'03

3 Record for Turbine

3-4 Unbalance Verification Test Record

c Bode Plot of Start up

[Note]

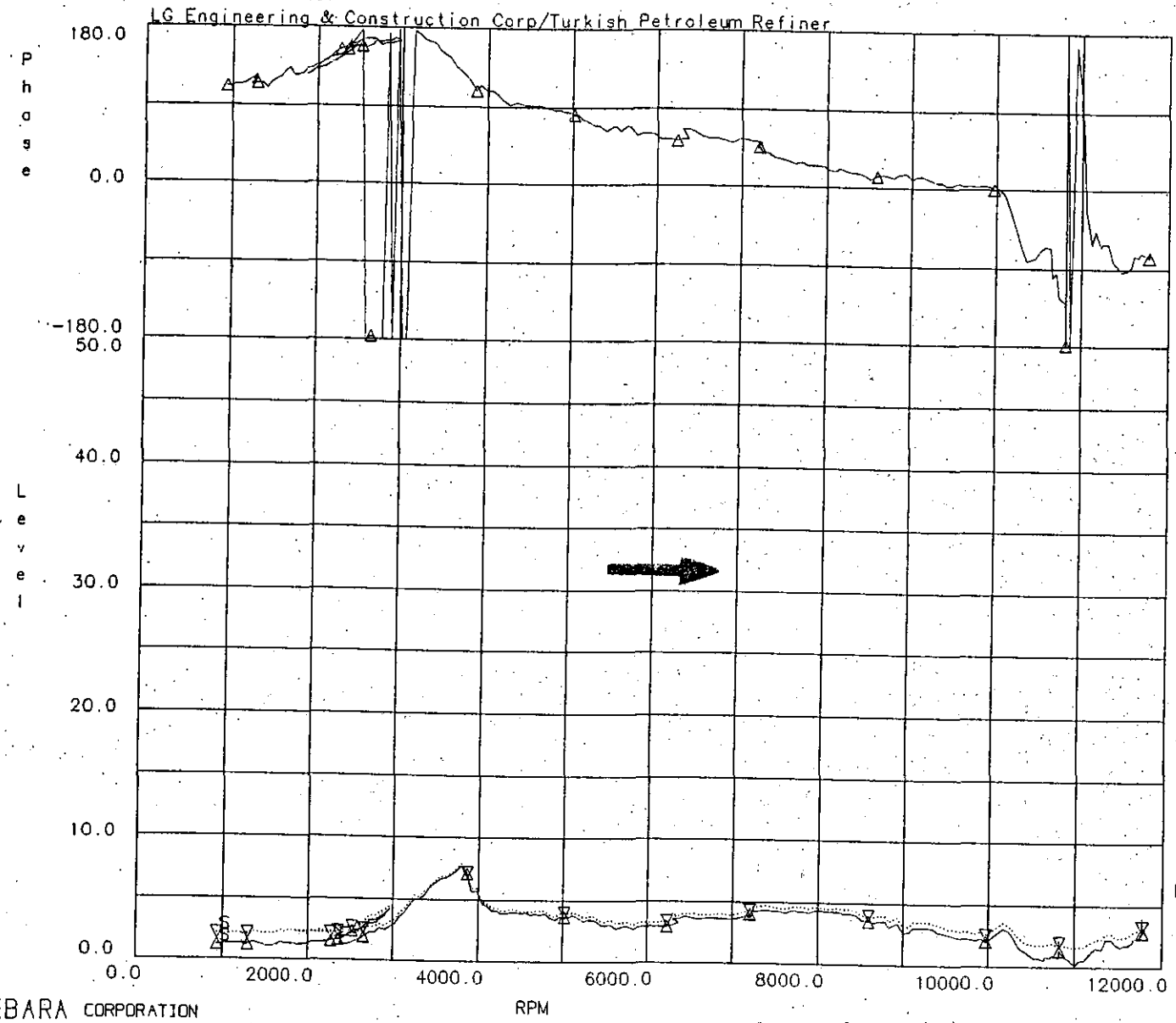
T.SE.X	:	Steam End X
T.SE.Y	:	Steam End Y
T.EE.X	:	Exhaust End X
T.EE.Y	:	Exhaust End Y

EO : 1.0	:	Synchronous Frequency
TOTAL	:	Overall
Unit	:	Vibration : μ m p-p
	:	Phase : Degree

R0215708
25MB5

SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
☑ WITNESSED ☐ REVIEWED
LG E&C

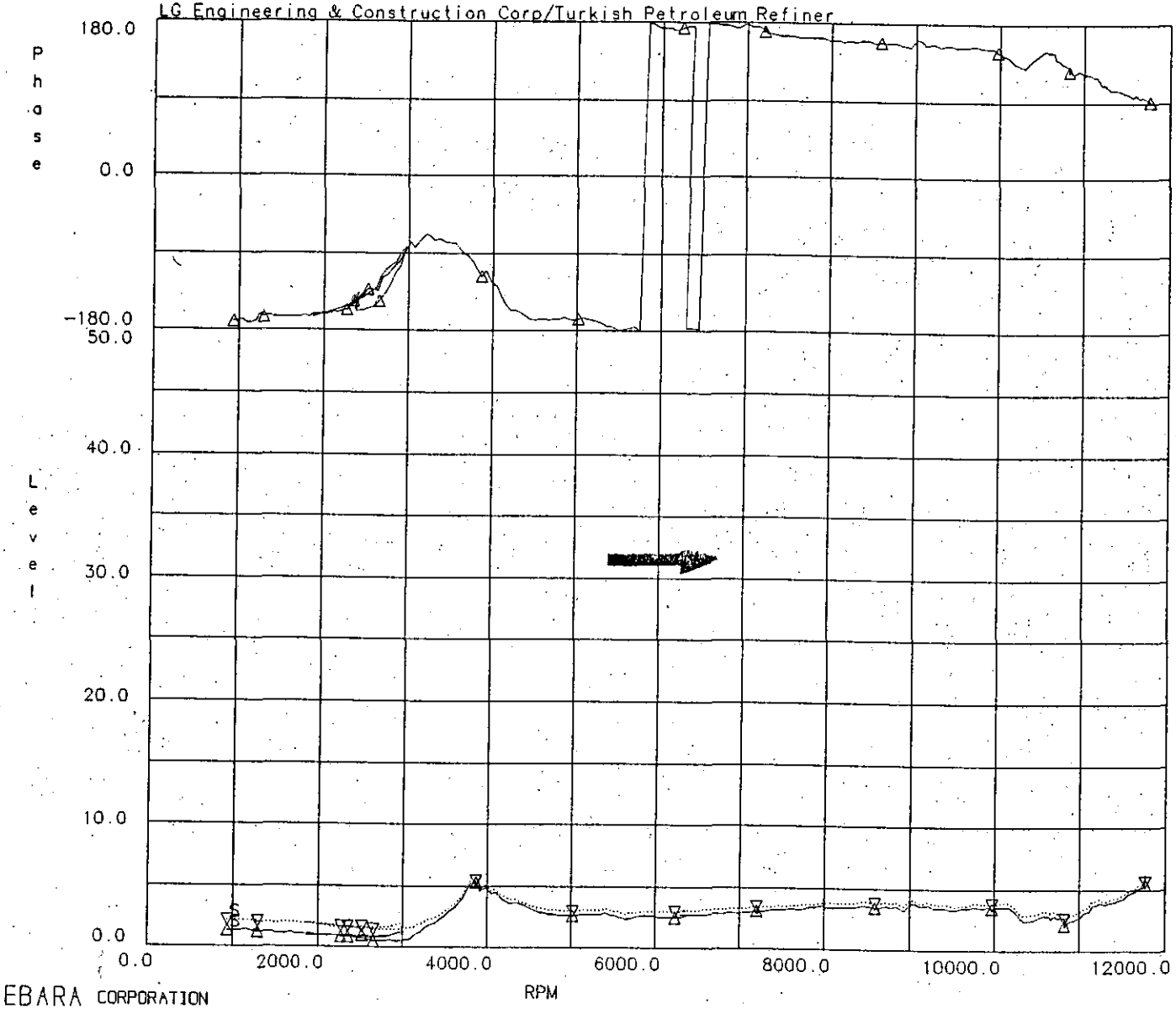
EBARA CORPORATION

Wed Oct 1 17:16:02 2003

R0215708
25MB5

SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
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LG E&C

EBARA CORPORATION

Wed Oct 1 17:16:02 2003

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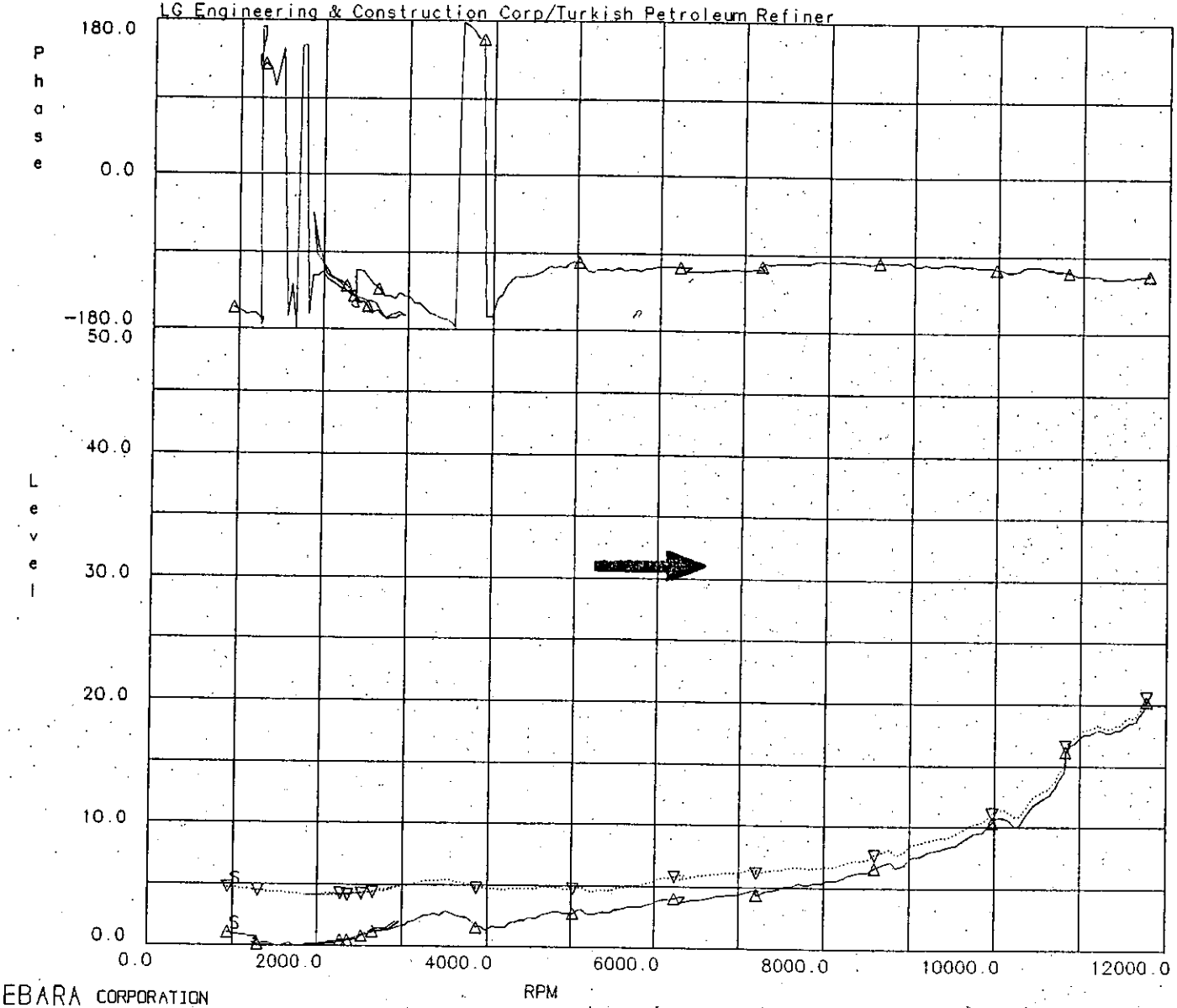
SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
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EBARA CORPORATION

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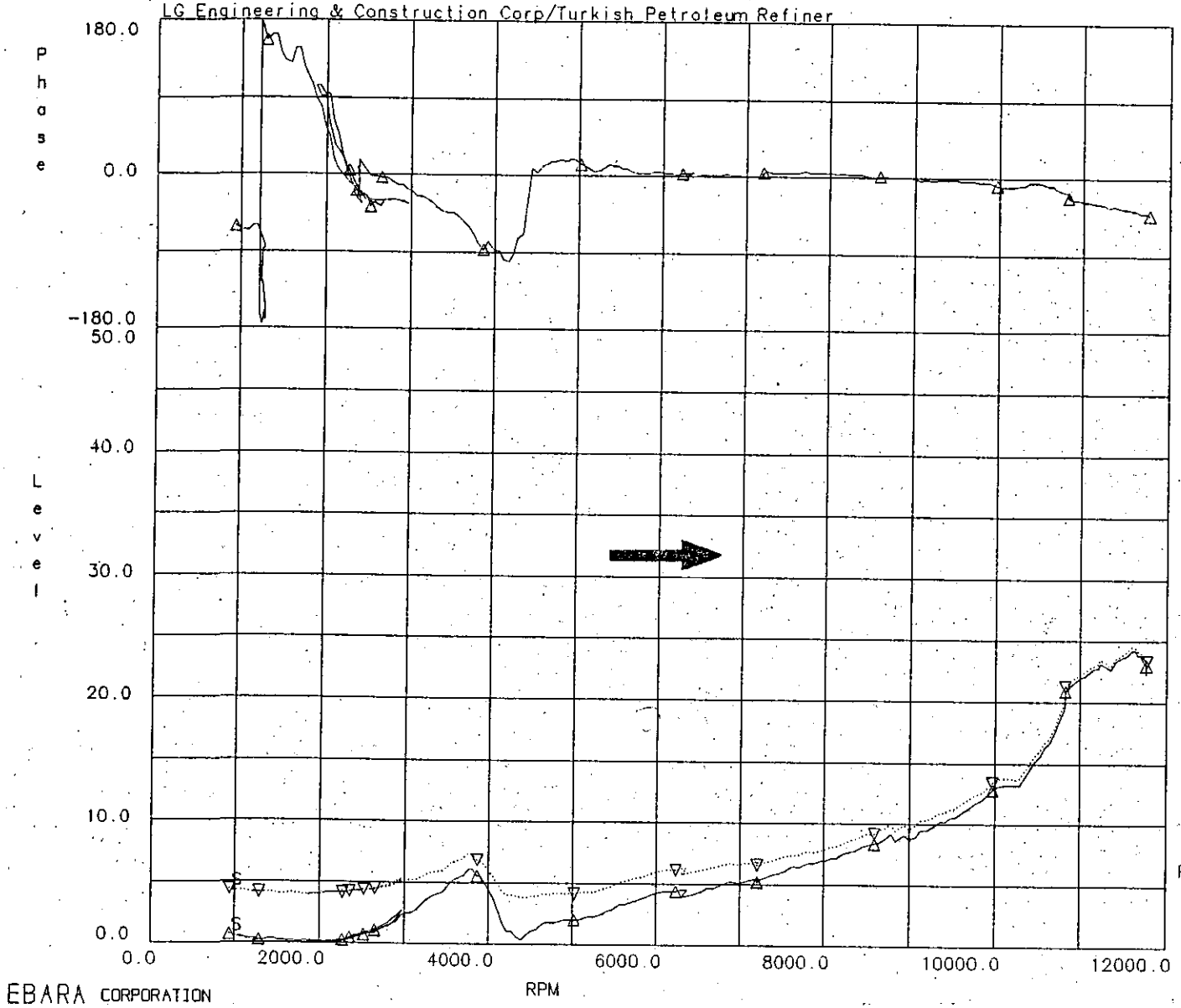
SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
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LG E&C

EBARA CORPORATION

Wed Oct 1 17:16:02 2003

3 Record for Turbine

3-4 Unbalance Verification Test Record

d Bode Plot of Coast Down

[Note]

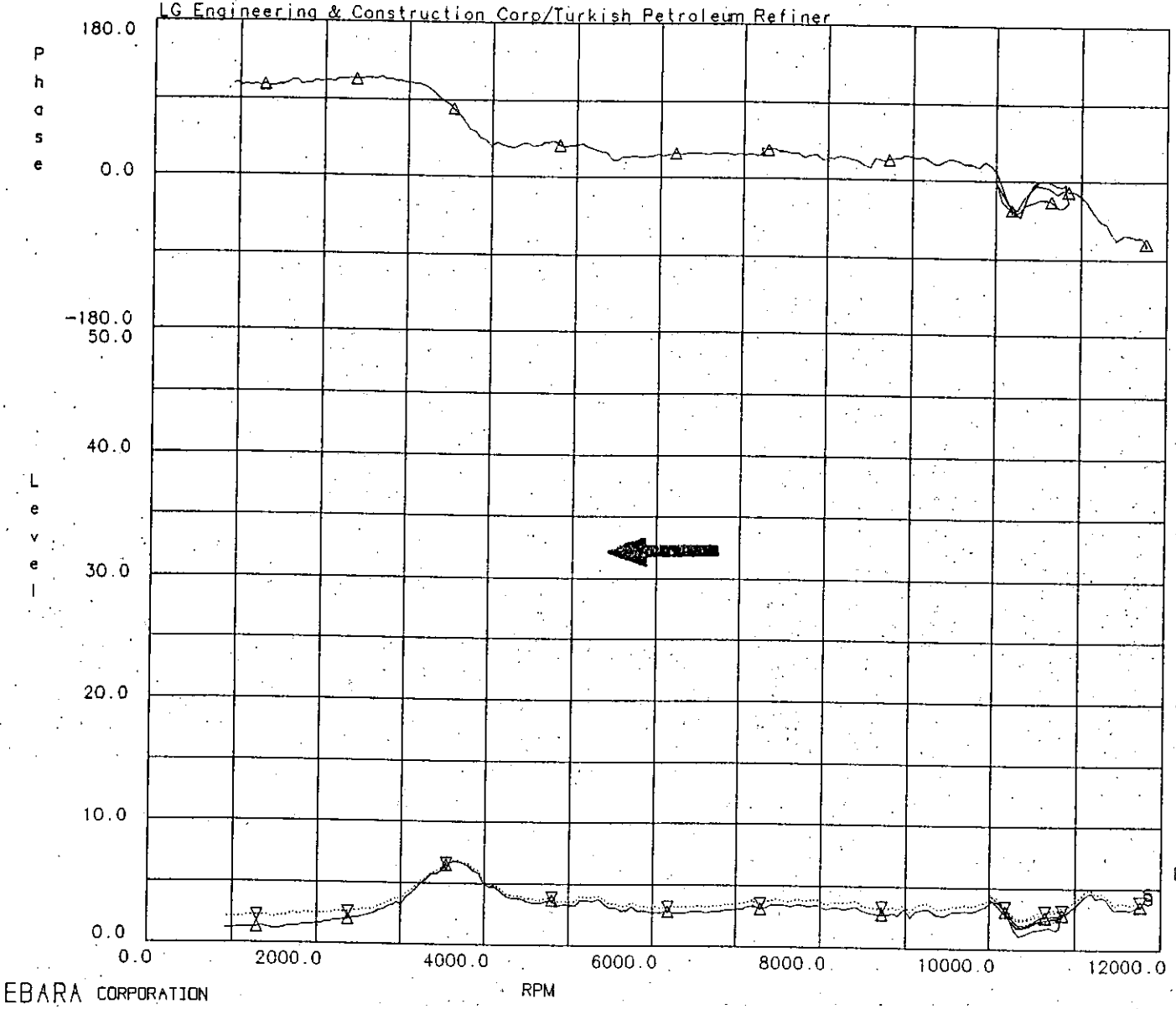
T.SE.X	:	Steam End X
T.SE.Y	:	Steam End Y
T.EE.X	:	Exhaust End X
T.EE.Y	:	Exhaust End Y

EO : 1.0	:	Synchronous Frequency
TOTAL	:	Overall
Unit	:	Vibration : μ m p-p
	:	Phase : Degree

R0215708
25MB5

SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
☑ WITNESSED ☐ REVIEWED
LG E&C

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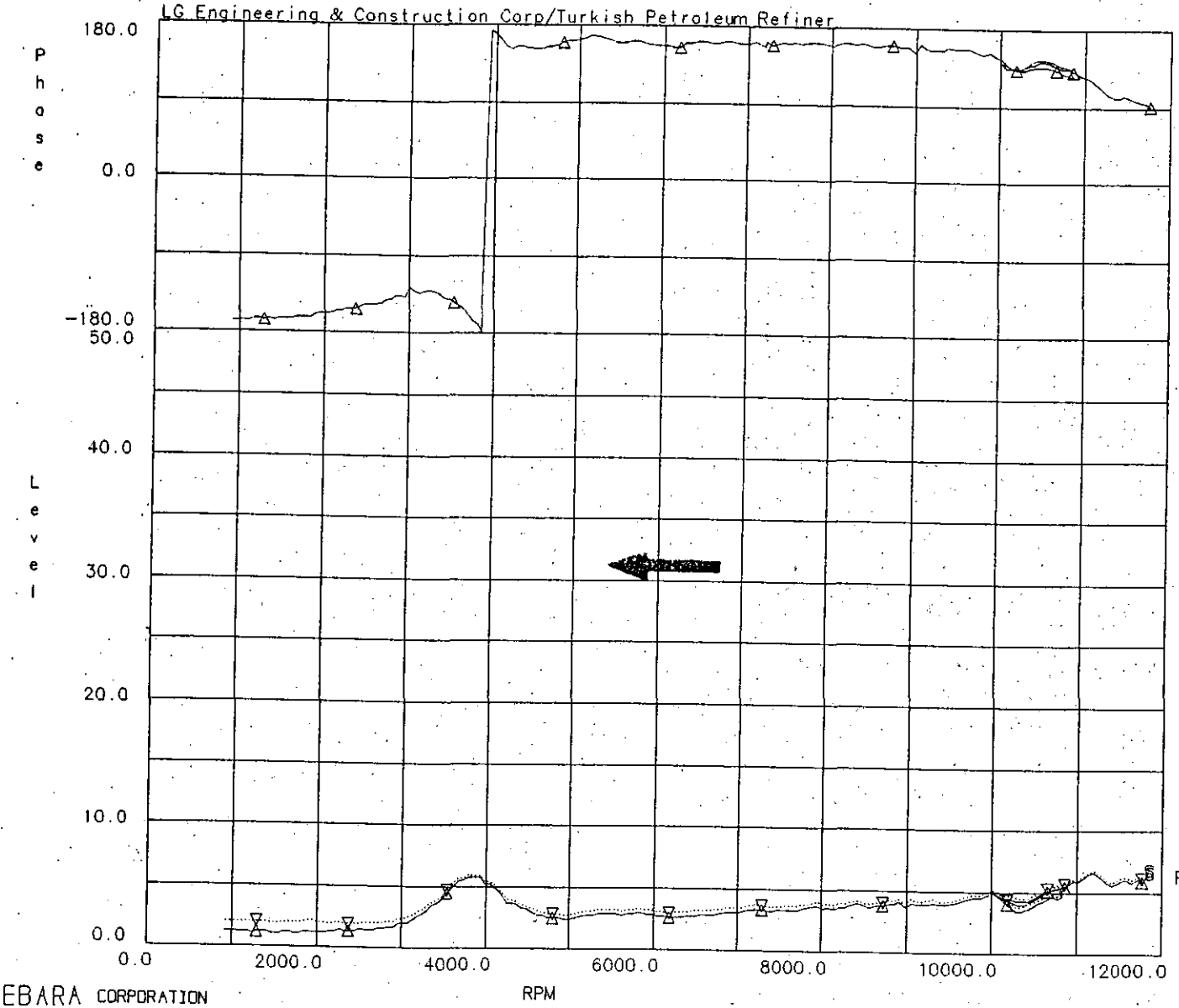
SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
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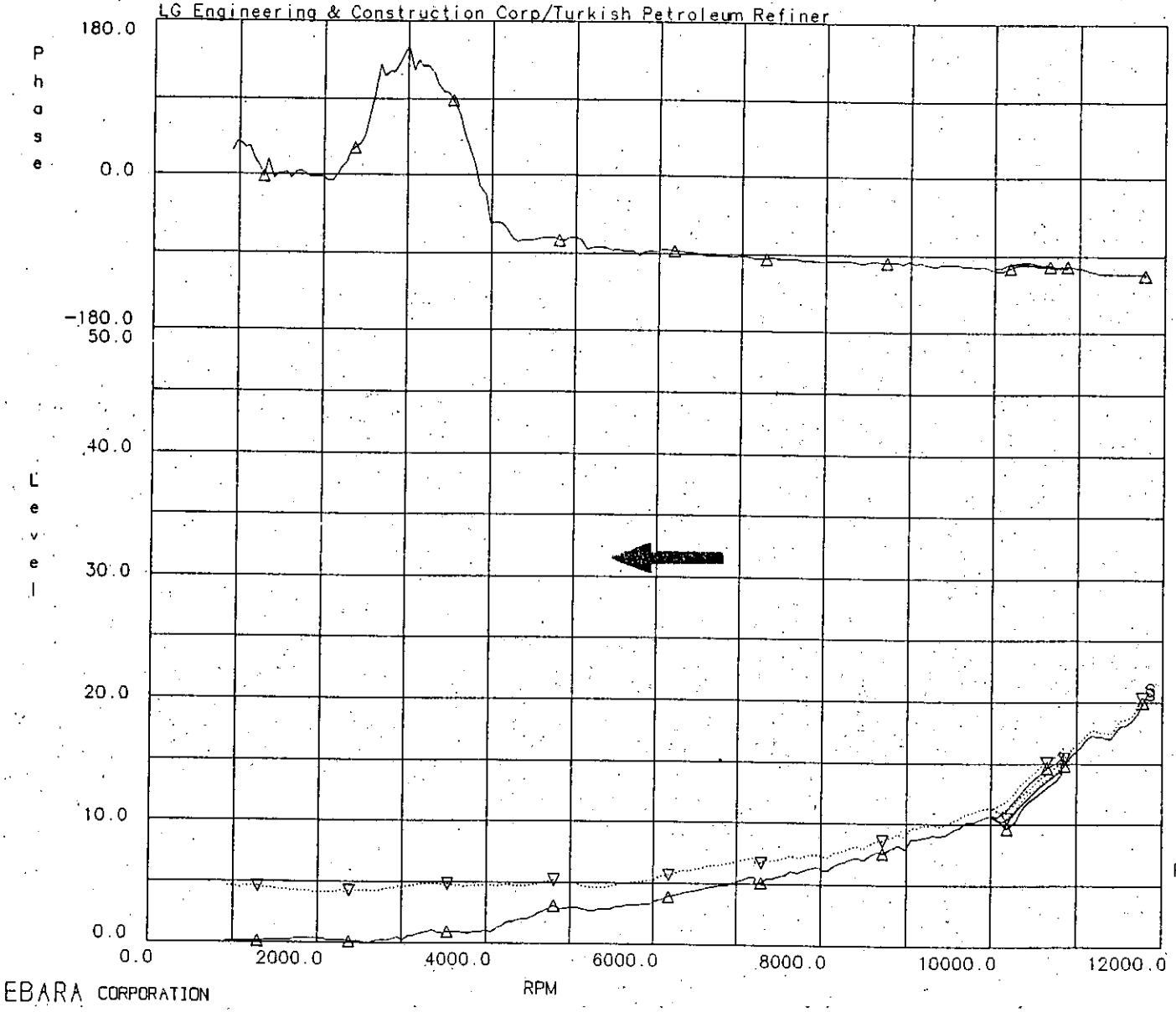
SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
☑ WITNESSED ☐ REVIEWED
LG E&C

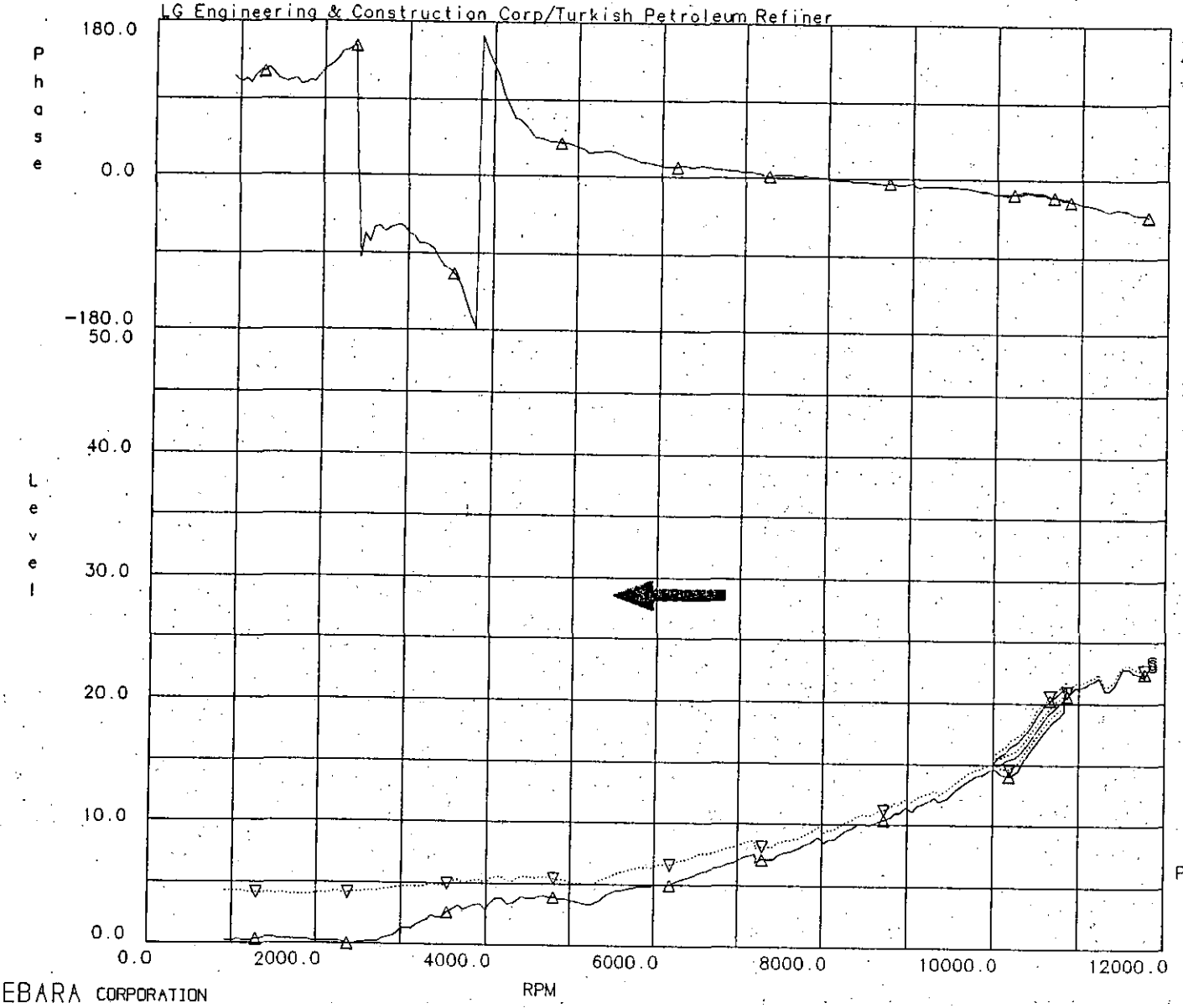
EBARA CORPORATION

Wed Oct 1 17:16:02 2003

R0215708
25MB5

SRV-5DF

LG Engineering & Construction Corp/Turkish Petroleum Refiner



INSPECTION TEAM
☑ WITNESSED ☐ REVIEWED
LG E&C

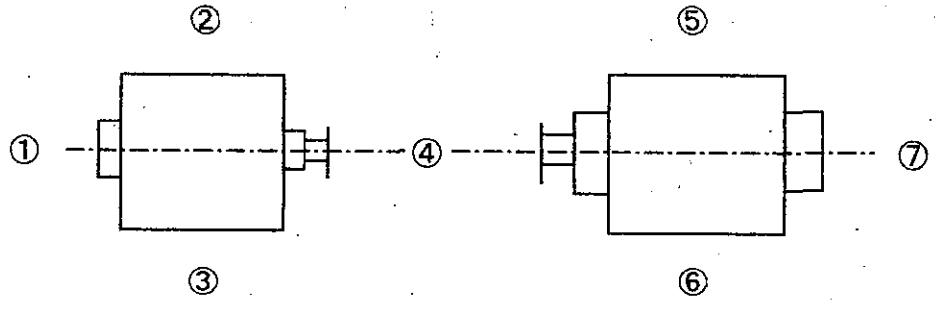
EBARA CORPORATION

Wed Oct 1 17:16:02 2003

5 Sound Level Record （ reference only ）

騒音記録
SOUND LEVEL RECORD

顧客名 CUSTOMER	アイテム NO. ITEM NO.	荏原製番 EBARA SER. NO.	機名 MODEL
LG Engineering & Construction Corp. Turkish Petroleum Refineries Corp.	CT-9901/TC-9901	R0215708	25MB5/SRV-5DF



単位(UNIT): dB (A)

時刻 TIME	回転数 SPEED min-1	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
15:09	10824	80.0	81.0	80.0	82.0	82.0	81.0	81.0			

時刻 TIME	回転数 SPEED min-1	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩

スケール (A)
SCALE

測定器 INSTRUMENT : RION NA-20

測定高さ (m) MEASURING HEIGHT : SHAFT CENTER

測定距離 (m) MEASURING DISTANCE : 1 m

暗騒音 dB(A) BACKGROUND NOISE 77 dB(A)

LG E&C INSPECTION TEAM ☑ WITNESSED ☐ REVIEWED Oct. 1'03

御立会者 WITNESSED BY 日付 DATE

審査 TEST ENGINEER H. Ishizawa 日付 DATE Oct 1st 03

記録 RECORDED BY K. Yoshida 日付 DATE 2003.10.1

ELLIOTT EBARA GROUP

Elliott Ebara Turbomachinery Corporation

5 Calibration Record

CALIBRATION RECORD (VIBRATION MONITORING SYSTEM)
振動計測システム検定記録

DATE (日付) : 2003/3/19

SYSTEM NO.(システムNo.) : B

INSTRUMENT	CASE	1		2		3		4		5		6	
FFT.Ch.A	FREQ'CY OF KEY PHASER キー周波数 (Hz)	100		100		300		300		750		750	
	VOLTAGE キー設定電圧値 (V)	4.95 (SET5V)		4.96 (SET5V)		4.96 (SET5V)		4.96 (SET5V)		4.97 (SET5V)		4.96 (SET5V)	
FFT.Ch.B	FREQ'CY OF VIBRATION 振動周波数 (Hz)	100		100		300		300		750		750	
	VOLTAGE 振動設定電圧値 (mV)	788.82		394.88		788.19		395.67		788.27		394.65	
	VIBRATION VALUE 振動測定値 (μm)	100.18 (SET100μm)		50.15 (SET50μm)		100.1 (SET100μm)		50.25 (SET50μm)		100.11 (SET100μm)		50.12 (SET50μm)	
VIBRATION VALUE (DIGTAL MULTI METER) デジタルマルチメーター振動測定値 (X) (μm)		100.10		50.12		100.01		50.23		100.22		50.04	
検定記録 CALIBRATION RECORD		READING (μm)	RATIO Y/X	READING (μm)	RATIO Y/X	READING (μm)	RATIO Y/X	READING (μm)	RATIO Y/X	READING (μm)	RATIO Y/X	READING (μm)	RATIO Y/X
EDAS値 (Y)	CH.1	101.33	1.012	50.28	1.003	100.82	1.008	50.35	1.002	102.02	1.018	50.73	1.014
	CH.2	102.24	1.021	49.88	0.995	100.24	1.002	50.66	1.009	101.22	1.010	50.91	1.017
	CH.3	101.23	1.011	50.00	0.998	100.35	1.003	50.26	1.001	100.62	1.004	50.62	1.012
	CH.4	99.96	0.999	50.75	1.013	99.64	0.996	50.50	1.005	100.60	1.004	50.81	1.015
	CH.5	99.71	0.996	50.21	1.002	99.44	0.994	50.67	1.009	100.90	1.007	50.61	1.011
	CH.6	98.53	0.984	50.57	1.009	100.43	1.004	50.54	1.006	99.85	0.996	50.56	1.010
	CH.7	99.21	0.991	49.93	0.996	100.17	1.002	50.38	1.003	100.47	1.003	50.87	1.017
	CH.8	99.96	0.999	49.95	0.997	100.04	1.000	51.11	1.018	101.02	1.008	50.81	1.015
	CH.9	100.23	1.001	50.19	1.001	100.85	1.008	50.80	1.011	100.08	0.999	50.70	1.013
	CH.10	101.91	1.018	50.74	1.012	100.09	1.001	50.55	1.006	101.50	1.013	50.78	1.015
	CH.11	100.46	1.004	50.17	1.001	100.00	1.000	51.09	1.017	100.37	1.002	50.56	1.010
	CH.12	101.18	1.011	50.19	1.001	100.75	1.007	50.14	0.998	100.53	1.003	50.56	1.010
	CH.13	101.26	1.012	49.96	0.997	101.01	1.010	50.00	0.995	100.90	1.007	50.22	1.004
	CH.14	100.13	1.000	50.04	0.998	99.92	0.999	50.57	1.007	100.43	1.002	51.02	1.020
	CH.15	99.73	0.996	50.28	1.003	99.82	0.998	50.68	1.009	100.65	1.004	50.62	1.012
	CH.16	99.93	0.998	50.21	1.002	99.77	0.998	51.23	1.020	100.32	1.001	50.92	1.018

ACCURACY
(合格基準) ± 3% of measured value

JUDGE
(判定) APPROVAL

INSPECTION TEAM
☐ WITNESSED ☑ REVIEWED
LG E&C Oct.1.'03

APPROVED BY
承認 N.Ishikawa
2003/3/19

CHECKED BY
担当 S.Suzuki
2003/3/19

計器検定成績書
INSTRUMENT TEST CERTIFICATE

管理番号
Manage No. 94H3725−5

型式 Type	デジタル回転計 TM-820	
測定範囲 Range	0 ～ 99999min-1	
最大許容差 Tolerance of Accuracy	3 Hz ～ 20 kHz	表示値 X (±0.02%) ± 1digit
	1 Hz ～ 3 Hz	表示値 X (±0.15%) ± 1digit
	0.1 Hz ～ 1 Hz	表示値 X (±0.08%) ± 1digit

基準器
Standard Instrument

型式 Type	FS-121A Digital Synthesizer	管理番号 Manage No.	SG−(1)-015

試験状態
Test Conditions

室温 Ambient Temp.	21℃

入力信号 7200 シリーズ

Frequency Input 入力周波数 (Hz)	Data 計測回転数 (r/min)	Result 校正結果
0.1	6	Acceptable 合格
10	600	
100	6000	
1000	60000	
1600	96000	

入力信号 MP-910
入力パルス数:60P/R 分周設定:60P/R

Frequency Input 入力周波数 (Hz)	Data 計測回転数 (r/min)	Result 校正結果
200	200	Acceptable 合格
1000	999	
10000	9999	
20000	20000	

入力信号 MP-981・LG-916
入力パルス数:60P/R 分周設定:60P/R

Frequency Input 入力周波数 (Hz)	Data 計測回転数 (r/min)	Result 校正結果
6	6	Acceptable 合格
10	10	
100	100	
1000	999	
10000	9999	
20000	19999	

LG E&C
INSPECTION TEAM
☐ WITNESSED ☑ REVIEWED

試験者
Tested By S.Suzuki

試験日
Date '03/3/5

EBARA

EBARA CORPORATION

様式－1

検査年月日 平成１５年０８月２７日	検査成績書 機器名：ﾊｲﾌﾞﾘｯﾄﾞﾚｺｰﾀﾞ 機器形式：ＲＤ３５００ 製造番号：４０３０３６５	発行元：日本電子応用(株) 大阪FCセンター
温度 ２２ ℃		検査責任者 溝口 保男
湿度 ６４ %		担当者 伊達 勉

検査項目	定格 及び 検査項目（条件）	判定
① 外観・機構	組み立て、ネジ締め付けの緩みがない。 スイッチ等が正常である。	合格
② 絶縁抵抗	AC電源入力端子 － ｱｰｽ端子間 DV500Vﾒｶﾞｰにて100MΩ以上	合格
	A/D変換器ﾕﾆｯﾄが1台実装されている場合 ・ｽｷｬﾅｺﾈｸﾀｱﾅﾛｸﾞ部(A/D1) － ｱｰｽ端子間 DC500Vﾒｶﾞｰにて100MΩ以上	
	A/D変換器ﾕﾆｯﾄが2台実装されている場合 ・ｽｷｬﾅｺﾈｸﾀｱﾅﾛｸﾞ部(A/D2) － ｱｰｽ端子間 ・ｽｷｬﾅｺﾈｸﾀｱﾅﾛｸﾞ部(A/D1) － ｽｷｬﾅｺﾈｸﾀｱﾅﾛｸﾞ部(A/D2) DC500Vﾒｶﾞｰにて100MΩ以上	合格
③ 記録部動作	ﾃｽﾄﾊﾟﾀｰﾝ Y-T記録動作確認 FEED 記録紙空送り動作確認 ﾍﾟｰﾊﾟｰｱｳﾄ 記録紙残量検出動作確認	合格
④ 性能	下記仕様を全て満たすこと ・直流電圧 積分時間:40/50/100ms	合格

レンジ	確度	分解能
± 20 mV	±0.02%rdg ±5digit	1 μV
± 200 mV	±0.02%rdg ±4digit	10 μV
± 2 V	±0.02%rdg ±4digit	100 μV
± 20 V	±0.03%rdg ±5digit	1 mV
± 50 V	±0.05%rdg ±5digit	10 mV

積分時間:16.7/20ms

レンジ	確度	分解能
± 20 mV	±0.05%rdg ±10digit	2 μV
± 200 mV	±0.05%rdg ± 8digit	20 μV
± 2 V	±0.05%rdg ± 8digit	200 μV
± 20 V	±0.07%rdg ±10digit	2 mV
± 50 V	±0.07%rdg ±10digit	20 mV

LG E&C

INSPECTION TEAM
☐ WITNESSED ☑ REVIEWED

発行番号:０３０３－５０３４	保管期間：3年	文書番号:FER03-0049	第２版	STD

機器形式： ＲＤ３５００　　製造番号： ４０３０３６５

検　査　項　目	定格　及び　検査項目（条件）	判　定
④ 性　　能	・熱電対 積分時間:40/50/100ms	合　格

ﾚﾝｼﾞ	測定範囲	確　度	分解能
R･S	0～ 300℃	± 0.05% ±1.0℃	0.1℃
	300～1760℃	〃 ±0.7℃	
B	400～1100℃	± 0.05% ±1.2℃	0.1℃
	1100～1820℃	〃 ±0.7℃	
K	-200～-100℃	± 0.05% ±0.8℃	0.1℃
	-100～1370℃	〃 ±0.5℃	
E	-200～1000℃	± 0.05% ±0.6℃	0.1℃
J	-200～1200℃	± 0.05% ±0.6℃	0.1℃
T	-200～ 400℃	± 0.05% ±0.5℃	0.1℃
N	-100～1300℃	± 0.05% ±0.6℃	0.1℃
W	0～2320℃	± 0.05% ±1.1℃	0.1℃
PR	0～1600℃	± 0.05% ±1.0℃	1.0℃
Kp	0～ 300K	± 0.05% ±1.0K	0.1K

※W:WRe5-WRe26、Kp:KpAu7Fe

積分時間:16.7/20ms

ﾚﾝｼﾞ	測定範囲	確　度	分解能
R･S	0～ 300℃	± 0.07% ±2.0℃	0.1℃
	300～1760℃	〃 ±1.5℃	
B	400～1100℃	± 0.07% ±3.0℃	0.1℃
	1100～1820℃	〃 ±2.0℃	
K	-200～-100℃	± 0.07% ±2.0℃	0.1℃
	-100～1370℃	〃 ±1.5℃	
E	-200～1000℃	± 0.07% ±1.5℃	0.1℃
J	-200～1200℃	± 0.07% ±2.0℃	0.1℃
T	-200～ 400℃	± 0.07% ±1.5℃	0.1℃
N	-100～1300℃	± 0.08% ±2.0℃	0.1℃
W	0～2320℃	± 0.1 % ±3.0℃	0.1℃
PR	0～1600℃	± 0.07% ±2.0℃	2.0℃
Kp	0～ 300K	± 0.07% ±2.0K	0.1K

・測温抵抗体　（導線形式:2･3導線、分解能:0.1℃）
積分時間:40/50/100ms

レンジ	測定範囲	確　度
Pt100Ω	-200～ 650℃	± 0.1 rdg ±0.3℃
JPt100Ω	-200～ 500℃	

積分時間:16.7/20ms

レンジ	測定範囲	確　度
Pt100Ω	-200～ 650℃	± 0.12rdg ±0.7℃
JPt100Ω	-200～ 500℃	

LG E&C

INSPECTION TEAM
☐ WITNESSED ☑ REVIEWED

機器形式： RD3500 製造番号： 4030365

検査項目	定格 及び 検査項目（条件）	判定
④ 性能	・ひずみ 積分時間:40/50/100ms レンジ / 測定範囲 / 確度 / 分解能 20000με / ±20000με / ±0.1 %F.S / 1με 200000με / ±200000με / 10με 積分時間:16.7/20ms レンジ / 測定範囲 / 確度 / 分解能 20000με / ±20000με / ±0.15%F.S / 2με 200000με / ±200000με / 20με	合格
⑤ パルス列動作	正常にｶｳﾝﾄ動作すること	合格
⑥ 内部基準接点補償動作	温度ｽｷｬﾅ端子台部の温度ｾﾝｻが室温を測定していること	合格
⑦ メモリ動作	ﾒﾓﾘｶｰﾄﾞﾃﾞｰﾀの書き込み及び読み込み動作確認	合格
⑧ ｽｷｬﾅﾕﾆｯﾄ（本体実装ﾕﾆｯﾄ）	温度・電圧ｽｷｬﾅﾕﾆｯﾄ(DE10-202)動作確認	合格
	NDISひずみｽｷｬﾅﾕﾆｯﾄ(DE10-203)動作確認	
	パルス列ｽｷｬﾅﾕﾆｯﾄ(DE10-204)動作確認	
	端子台ひずみｽｷｬﾅﾕﾆｯﾄ(DE10-205)動作確認	
	端子台ひずみｽｷｬﾅﾕﾆｯﾄ(DE10-206)動作確認	
	温度・電圧ｽｷｬﾅﾕﾆｯﾄH(DE10-207)動作確認	
	温度・電圧ｽｷｬﾅﾕﾆｯﾄV(DE10-208)動作確認	
	温度・電圧無接点ｽｷｬﾅﾕﾆｯﾄ(DE10-210)動作確認	
⑨ オプション	ｺﾐｭﾆｹｰｼｮﾝﾕﾆｯﾄ(RD35-106)動作確認	合格
	ｱﾗｰﾑ出力ﾕﾆｯﾄ(RD35-108)動作確認	
	ﾘﾓｰﾄｺﾝﾄﾛｰﾙﾕﾆｯﾄ(RD35-109)動作確認	
	内部照明(RD35-110)動作確認	合格
	LG E&C INSPECTION TEAM ☐ WITNESSED ☑ REVIEWED	

発行番号:0303－5034	保管期間：3年	文書番号:FER03-0049	第2版	STD

校正証明書

株式会社荏原エリオット　　殿

発行日：平成１５年０８月２７日
日本電子応用電機株式会社
大阪Ｆ営業所

試験日　　：平成１５年０８月２７日
証明書発行番号：０３０１－５１３３
製品形式番号　：ＲＤ３５００
製造番号　　：４０３０３６５
製品名称　　：ハイブリッドレコーダ
成績書発行番号：０３０３－５０３４

上記製品は、当社の工業標準に基づき試験が行われ、試験結果は仕様を満たしています。

この試験にかかわる測定は、独立行政法人産業技術総合研究所等の公的研究所、またそれらの研究所によって認められている校正機関、また国際度量衡委員会に加盟している各国標準研究所または公的校正機関にトレーサビリティがとれています。

別紙に使用したワーク用測定器のトレーサビリティチャートを示します。

使用したワーク用測定器一覧

名　　称	形式	管理番号	有効期限
超絶縁計	SM-5E	FEW-06-005	平成１６年０１月
ﾃﾞｼﾞﾀﾙﾏﾙﾁﾒｰﾀ	R6581	FEW-03-002	平成１６年０１月
直流電圧発生器	R6161	FEW-14-010	平成１６年０１月
ﾌｧﾝｸｼｮﾝｼﾝｾｻｲｻﾞ	1930A	FEW-05-005	平成１５年１２月
ﾕﾆﾊﾞｰｻﾙｶｳﾝﾀ	TR5821	FEW-05-006	平成１５年１２月
ＣＡＬＢＯＸ	120Ω	FEW-18-010	平成１６年０１月
0℃基準器	ZC-114	FEW-07-015	平成１６年０１月
熱電対Ｔ型	T35	FEW-07-018	平成１７年０１月
6ﾀﾞｲｱﾙ可変抵抗	2793-01	FEW-16-004	平成１６年０１月
ﾀﾞｲｱﾙ型可変抵抗	2786	FEW-16-008	平成１６年０１月

NEC San-ei Instruments, Ltd.

LG E&C　INSPECTION TEAM ☐ WITNESSED ☑ REVIEWED

検査成績書

TEST REPORT

Ship No. －－－－－－－

TAG No. －－－－－－－

器物番号 0052442
Serial No

流量計仕様 Flow Meter Specification

口 径 Size	50mm	受信器 Electric-instrument 変換器 Converter	－－－－－－ －－－－－－ －－－－－－
型 式 Model	RQE1050B0FF233450010R		
液体名 Fluid	タービン油		
	80 ℃	ｱﾅﾛｸﾞ信号 Analog signal	ﾌﾙｽｹｰﾙ Full Scale 4～20mA 0～15m³/h －－－－－－
流量範囲 Flow Range	0.7～15m³/h	パルス信号 Pulse signal	流量計発信パルス単位 Transmitter output unit 1L/P
			変換器出力パルス単位 Converter output unit －－－－－－

試験成績 (Test Data)

m f =74.50 mL/P

器差 Accuracy Within (±0.5%)	流量m³/h Flow Rate	0.7	12	15	－－－－ －－	－－－－ －－	合格 Acceptable
	器差 (%) Accuracy	0.00	+0.21	+0.20	－－－－ －－	－－－－ －－	
	－－－－－－						
指示差、出力試験 Indicate Test	ﾌﾙｽｹｰﾙの－－－－－－－ Full scale Within						合格 Acceptable
	0～15 m³/h (4～20mA) (－－－－－－－)						
パルス試験 Pulse Test	流量計発信ﾊﾟﾙｽ単位 1L/P Transmitter output unit			変換器ﾊﾟﾙｽ出力単位 －－－－－－ Converter output unit			合格 Acceptable
耐圧試験 Pressure Proof Test	水圧 －－－－－－－ －－－－－－ Water Proof Pressure						
ストレーナー Strainer	型式 (－－－－－－－) Strainer			耐圧試験 (－－－－－－ －－－－－－) Pressure proof Test			
その他 Remarks	－－－－－－						

試験日 H14/10/22 Test Date	検査 Inspector 大規	承認 Approved 矢野	日東精工株式会社 NITTO SEIKO CO., LTD.
成績 (　) 部 取説 (　) 部	LG E&C INSPECTION TEAM ☐ WITNESSED ☑ REVIEWED		工事番号 M59371 Job No.

校正証明書

品名	:	
型式	:	RQE1050B0FF233450010R
器物番号	:	0052442
工事番号	:	M59371
校正年月日	:	H14/10/22

※校正機器

校正機器名	:	液体メーター用基準タンク
型式または能力	:	全量 300L
器物番号	:	441
有効期限	:	平成１２年１１月１４日 ～平成１７年１１月１３日まで

本流量計は、ＪＩＳ Ｂ ７５５２(液体用流量計器差試験方法)で規定されたタンクによる方法によって、校正したことを証明します。

LG E&C INSPECTION TEAM ☐ WITNESSED ☑ REVIEWED

H14/10/22

校正会社名 : 日東精工株式会社
制御システム事業部

所 在 地 : 京都府綾部市延町野土畑３０番地

計器検定成績書

INSTRUMENT TEST CERTIFICATE

管理番号: NO-(1)-005 (Manage No.)　　計器番号: 66347892 (Mfg. No.)

型　式: NA-20 (Type)　　測定範囲: 31.5～8000 Hz (Range)

最大許容差 (Tolerance of Accuracy) : ± 1.5 dB

基準器
Standard Instrument

型　式: Type	NC-72
名　称: Description	PISTON PHONE
計器番号: Mfg. No.	00330925
管理番号: Manage No.:	

試験状態: 良 (Test Conditions)

室　温: 20°C (Ambient Temp.:)　　大気圧: (Barometer)

試験結果
Test Results

基準入力 Standard Input	250Hz / 114.0dB				
計器の読み(dB) Instrument Reading	114.0				
誤　差(dB) Errors	0				
判　定 Acceptability	合　格 ACCEPTABLE				

備　考: 騒音計 (Note)

承認者: (App'd by)

試験者: 阿津 (Tested by)

試験日: '03. 1. 10 (Date)

LG E&C　INSPECTION TEAM　☐ WITNESSED ☑ REVIEWED

EBARA

MISUZU

INSPECTION REPORT

CUSTOMER : ELLIOTT-EBARA TURBOMACHINERY CORPORATION

ARTICLE : LUBE OIL CONSOLE UNIT

ITEM : SHOP MECHANICAL RUNNING TEST

DRAWING NO. : ER02157080/902 (K1-01692)

EBARA SER. NO. : R0215708

ITEM NO. : CT-9901/TC-9901

SERIAL NO. : U-2549

INSPECTION DATE : 30th OCT. 2003

CUSTOMER : LG ENGINEERING & CONSTRUCTION CORP.

FINAL USER : TURKISH PETROLEUM REFINERIES CORP.

PROJECT : TUPRAS IZMIR REFINERY DHP PROJECT

JOB. NO. : 7020

SERVICE : RECYCLE GAS COMPRESSOR

LG E&C INSPECTION TEAM ☑WITNESSED ☐REVIEWED Oct. 30 '03

ELLIOTT EBARA GROUP ☑Witnessed ☐Reviewed

EETC Q.C. Dept. Oct. 30, 03

Certified by : H. Tanaka

Inspected by :

MISUZU Industrial Corporation

MISUZU

U-2549

CUSTOMER : LG ENGINEERING & CONSTRUCTION CORP.
FINAL USER : TURKISH PETOROLEUM REFINERIES CORP.
ITEM NO. : CT-9901/TC-9901

LUBE & CONTROL OIL CONSOLE

MECHANICAL RUNNING & FUNCTIONAL TEST

EBARA SERIAL NO R021570804
DATE OF TEST 30th Oct. 2003
PLACE OF TEST MISUZU Industrial Corporation

Items	Operating Condition	Time	Temperature: Room	Temperature: Oil Reservoir	Temperature: Oil Cooler Inlet	Temperature: Oil Cooler Outlet	Pressure: Pump Derivary Main	Pressure: Pump Derivary Standby	Pressure: Oil Header	Pressure: Lube Oil Outlet	Pressure: Control Oil Outlet	Pressure: Oil Filter ΔP	Flow Rate: Lube Oil	Flow Rate: Control Oil	MOTOR: Voltage	MOTOR: Current Main	MOTOR: Current Standby	MOTOR: Revolution Main	MOTOR: Revolution Standby	Remarks
Unit			℃				kg/cm²G						m³	/ hr.	V	A		min⁻¹		
Specified Value	Max. / Nor.			62	62	49～43	22.0	22.0	15.0	2.64	8.59	Max.1.0	12.06	1.82	380	(29)	34	(3000ss)	2935	
Tag. No.			Shop	TI－9900－651	TI－9900－652	TI－9900－653	PI－9900－652A	PI－9900－652B	PI－9900－654	PI－9900－656	PI－9900－657	PDI－9900－653	Shop	Shop	Shop	Shop	Shop	Shop	Shop	
TEST-1 A	Normal Condition (Standby Pump)	10:15	17.5	47.0	44.0	44.0	――	15.8	15.0	2.70	8.60	0.24	12.57	1.91	390	――	19.4	――	2963	
TEST-1 B	Paralel running (Main Pump & Standby Pump)	10:25	18.5	47.0	44.0	45.0	17.0	17.0	16.0	2.71	8.80	0.24	12.65	1.91	390	20.3	20.2	2926	2929	
TEST-1 C	Normal Condition (Main Pump)	10:35	19.0	48.0	44.0	47.0	15.8	――	15.0	2.70	8.60	0.24	12.59	1.91	390	19.6	――	2962	――	
TEST-1 D	Oil Cooler & Cooler & Filter change over (Main Pump)	10:45	19.0	48.0	44.0	47.0	15.9	――	15.0	2.70	8.60	0.24	12.62	1.90	390	19.3	――	2963	――	
TEST-2 A	Auto-Start Main→Standby Pump (Standby Pump)	10:55	19.0	48.0	44.0	47.0	――	16.1	15.4	2.70	8.60	0.24	12.62	1.91	390	――	19.6	――	2954	
TEST-2 B	Normal Condition (Standby Pump) Cooler & Filter change over	11:05	19.0	48.0	45.0	47.0	――	16.1	15.3	2.70	8.60	0.24	12.61	1.90	390	――	19.5	――	2953	
TEST-2 C	Normal Condition (Standby Pump) Inner leakage check of tranfer valve	11:15	19.0	48.0	45.0	47.5	――	16.0	15.1	2.70	8.60	0.24	12.61	1.91	390	――	19.4	――	2954	
TEST-3	Normal Condition (Main Pump)	11:50	21.0	47.0	45.0	46.0	16.0	――	15.5	2.70	8.80	0.26	12.56	1.91	390	19.6	――	2950	――	
		12:50	21.0	45.0	44.0	44.5	15.8	――	15.0	2.70	8.80	0.26	12.51	1.89	390	19.3	――	2951	――	
		13:50	23.0	46.0	45.0	45.0	16.0	――	15.4	2.70	8.80	0.26	12.52	1.91	390	19.5	――	1945	――	
		14:50	23.0	47.5	47.0	47.0	15.9	――	15.1	2.70	8.70	0.26	12.59	1.90	390	19.4	――	2949	――	
		15:50	23.0	48.5	47.0	48.0	15.8	――	15.0	2.70	8.70	0.26	12.60	1.91	390	19.2	――	2947	――	

VERIFICATION OF SAFETY SYSTEM

No.	Name of Article	Items	Specified Value	Tag. No.	Result	Remarks
1	Relief Valve	Main oil pump	22.0 kg/cm²G	PSV-9900-651A	Acceptable	Accumulation : less than 10 %
2	Relief Valve	Standby oil pump	22.0 kg/cm²G	PSV-9900-651B	Acceptable	
3	Pressure Switch	Main oil pump discharge	13.5 kg/cm²G	PSL-9900-651	Acceptable	
4	Pressure Switch	Standby oil pump discharge	6.8 kg/cm²G	PSH-9900-652	Acceptable	
5	Pressure Switch	Header pressure	13.5 kg/cm²G	PSL-9900-654	Acceptable	
6	Pressure Switch	Standby oil pump start	13.5 kg/cm²G	PSL-9900-655	Acceptable	
7	Diff. Press. Switch	Oil Filter diff. press	1.5 kg/cm²	PDSH-9900-653	Acceptable	
8	Oil reservoir	Oil min. level (Flange distance)	280 mm	LSL-9900-651	Acceptable	
9	Thermo. Switch	Oil cooler outlet	54.0 ℃	TSH-9900-653	Acceptable	

VERIFICATION OF OPERATING CONDITION

Items	Result	
Control valve operation	Acceptable	Min. Lube Oil supply pressure : 2.5 kg/cm²G
Oil Cooler changeover	Acceptable	
Oil filter changeover	Acceptable	
Oil Pump parallel running	Acceptable	
Standby Oil pump auto-start	Acceptable	
Cleanliness check of system	Acceptable	
External Oil leakage check	Acceptable	
Accumulator holding time	Acceptable	

Remarks :

INSPECTION TEAM
☑WITNESSED ☐REVIEWED
LG E&C Oct.30'03

Witness by : ELLIOTT EBARA GROUP
☑Witnessed ☐Reviewed
EETC Q/C Dept. Oct. 30, '03

MISUZU Industrial Corporation
H. Tanaka

MISUZU

INSPECTION REPORT

CUSTOMER :
ELLIOTT-EBARA TURBOMACHINERY CORPORATION

ARTICLE :
LUBE OIL CONSOLE UNIT

INSPECTION ITEM :
NOISE LEVEL CHECK

DRAWING NO. :
ER02157080/902 (K1-01692)

EBARA SER. NO. :
R0215708

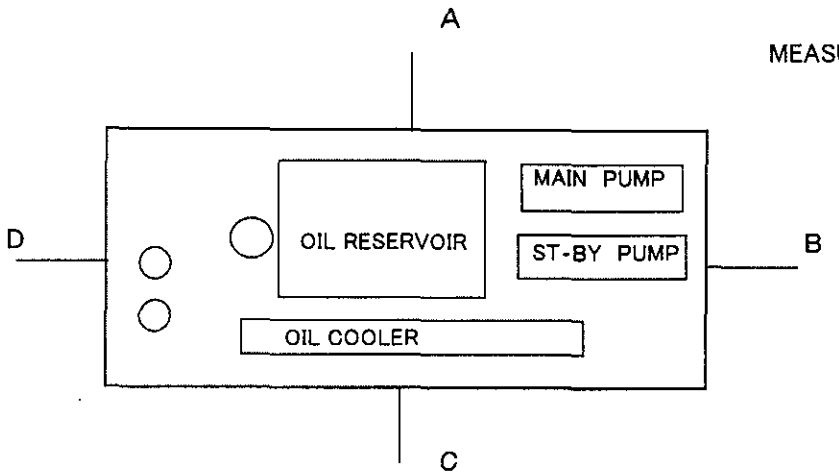
ITEM NO. :
CT-9901/TC-9901

SERIAL NO. :
U-2549

INSPECTION DATE :
30th OCT. 2003

MEASURED HEIGHT :
1.5 meter

MEASURED DISTANCE :
1.0 meter



UNIT : dB(A)

For REFERENCE							
MEASURING POSITION		A	B	C	D	REVOLUTION	
ACTUAL VALUE	Main oil pump	78	79	75	82	2980	min^{-1}
	Standby oil pump	78	81	76	82	2978	min^{-1}
BACKGROUND NOISE LEVEL		59					
TEST RESULT		ACCEPTABLE					
TESTER		RION CO. LTD. SERIAL NO. 01114630					

LG E&C INSPECTION TEAM ☑WITNESSED ☐REVIEWED Oct. 30 03

ELLIOTT EBARA GROUP ☑Witnessed ☐Reviewed

EETC Q.C Dept. Oct. 30, 03

Certified by : H. Tanaka

Inspected by :

MISUZU Industrial Corporation

MISUZU

INSPECTION REPORT

CUSTOMER :
ELLIOTT-EBARA TURBOMACHINERY CORPORATION

ARTICLE :
LUBE OIL CONSOLE UNIT

INSPECTION ITEM :
OIL PUMP VIBRATION & BEARING TEMP. CHECK

DRAWING NO. :
ER02157080/902 (K1-01692)

EBARA SER. NO. :
R0215708

ITEM NO. :
CT-9901/TC-9901

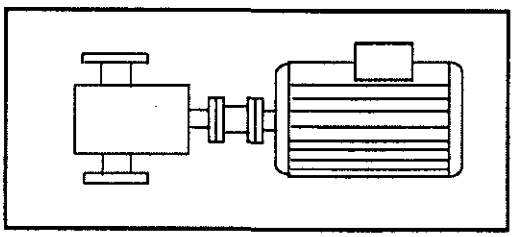
SERIAL NO. :
U-2549

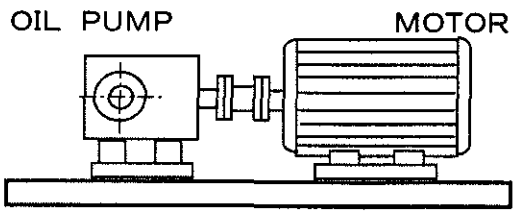
INSPECTION DATE :
30th OCT. 2003

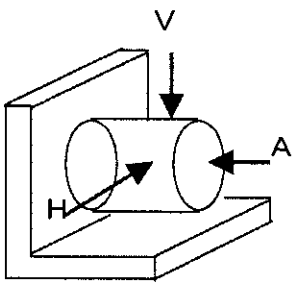
UNIT : μm

Oil Temp. 48.0 ℃

Ambient Temp. 24.0 ℃







V : Vartical
H : Horizontal
A : Axial

STANDARD		OIL PUMP : 20 μm			MOTOR : 25 μm			P-P
MEASURING POSITION		PUMP			MOTOR			REVOLUTION
		V	H	A	V	H	A	min^{-1}
ACTUAL VALUE	Main oil pump	5	8	7	(8)	(9)	(6)	2980
	Standby oil pump	7	8	7	6	9	7	2978
TEST RESULT		ACCEPTABLE						
TESTER		AKASHI MFG. SERIAL NO. 71232						

BEARING TEMPERATURE :

Main oil pump	45.0 ℃	Main pump Motor	46.0 ℃
Standby oil pump	46.0 ℃	Standby pump Motor	47.0 ℃

LG E&C INSPECTION TEAM ☑WITNESSED ☐REVIEWED Oct.30 '03 T. Tanaka

Within ambient Temp. +40℃ or Oil Temp. +20℃ which ever greater

Within ambient Temp. +40℃

Certified by : H. Tanaka

ELLIOTT EBARA GROUP ☑Witnessed ☐Reviewed Oct 30 03

Inspected by :

EETC Q.C Dept MISUZU Industrial Corporation

MISUZU

INSPECTION REPORT

CUSTOMER :
ELLIOTT-EBARA TURBOMACHINERY CORPORATION

ARTICLE :
LUBE OIL CONSOLE UNIT

INSPECTION ITEM :
VISUAL & DIMENSIONAL INSPECTION

DRW. NO. :
ER02157080/902 (K1-01692)

EBARA SER. NO. :
R0215708

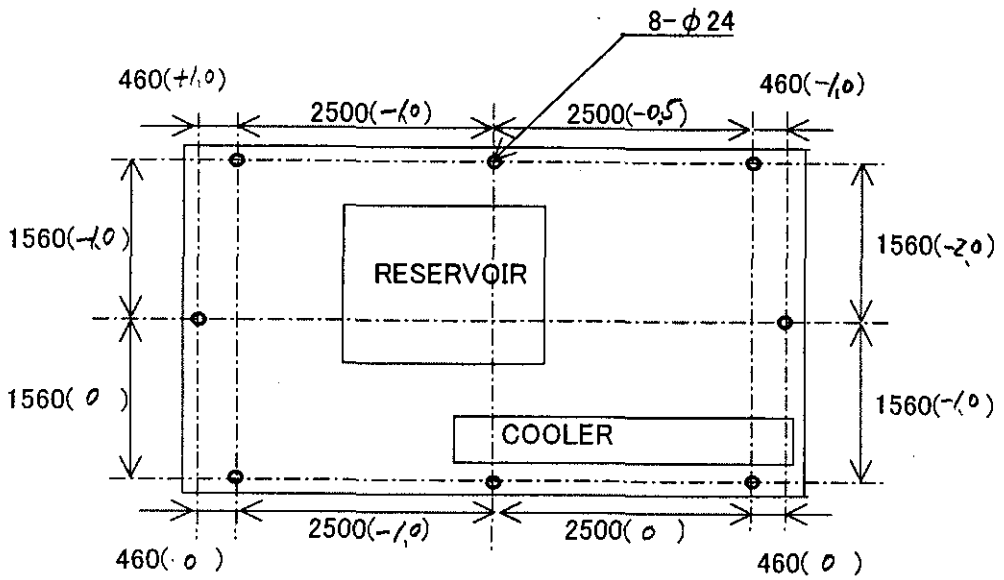
ITEM NO. :
CT-9901/TC-9901

SERIAL NO. :
U-2549

INSPECTION DATE :
30th OCT. 2003

Unit : mm

( ) : Actual



Allowable location of piping connecting end : ± 10 mm

Allowable anchor bolt hole pitch : ± 3 mm

INSPECTION TEAM
☑WITNESSED ☐REVIEWED
LG E&C Oct. 30 03

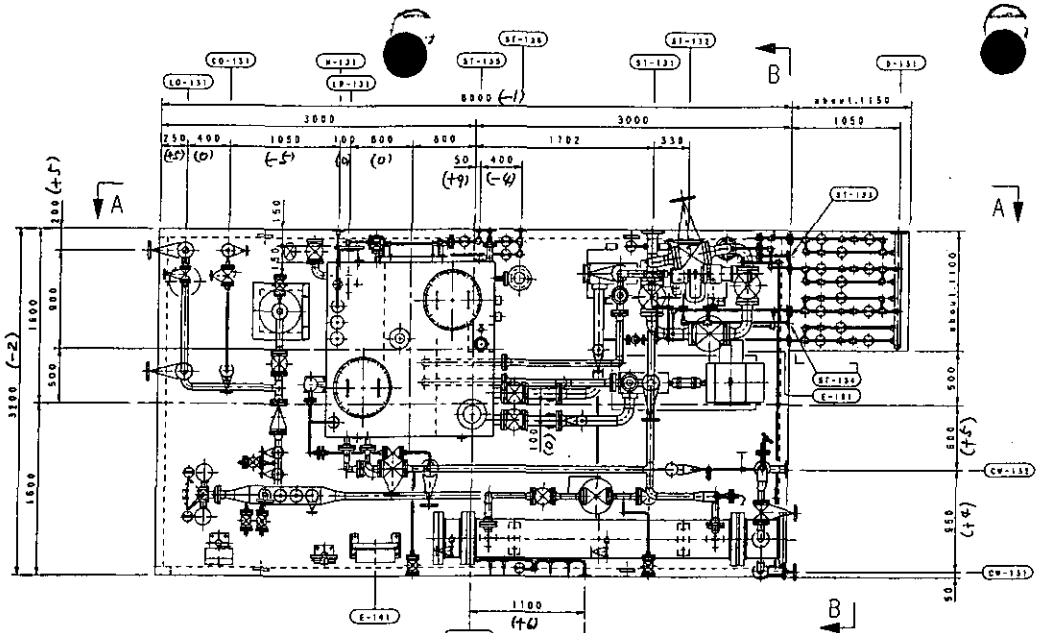
RESULT : ACCEPTABLE

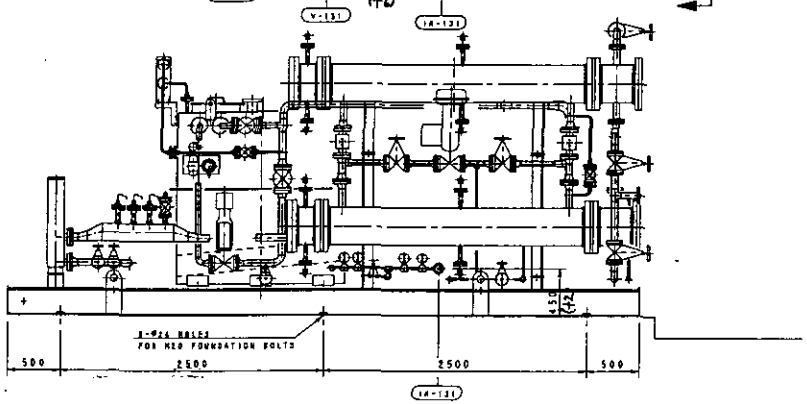
ELLIOTT EBARA GROUP ☑Witnessed ☐Reviewed
EETC Q.C Dept. Oct. 30, 03

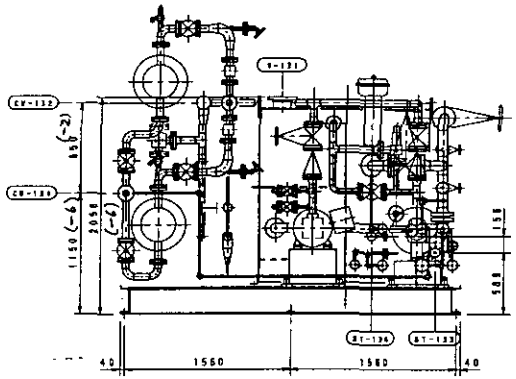
Certified by : H. Tanaka

Inspected by :

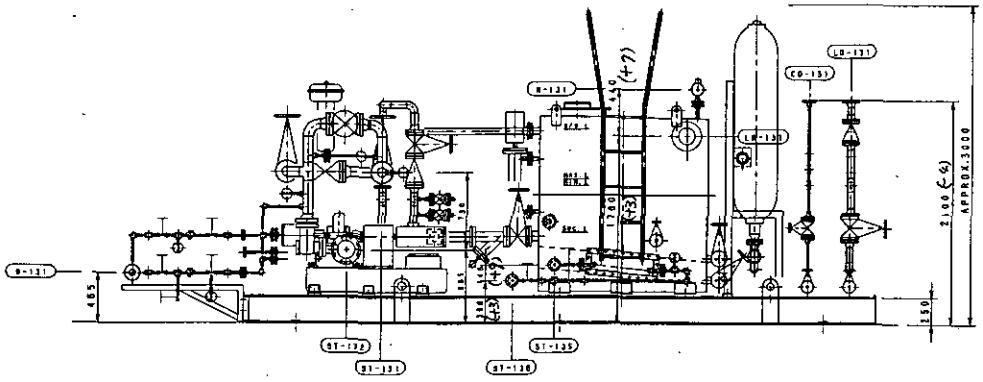
MISUZU Industrial Corporation







B - B



A - A

CONNECTION LIST					
NUMBER	COMMENTS	FLANGE SIZE & RATING	NUMBER	COMMENTS	FLANGE SIZE & RATING
LO-131	LUBE OIL SUPPLY	2" ANSI 150# RF	CW-131	COOLING WATER INLET	2" ANSI 150# RF
CO-131	CONTROL OIL SUPPLY	1½" ANSI 300# RF	CW-132	COOLING WATER OUTLET	2" ANSI 150# RF
LR-131	LUBE OIL RETURN	4" ANSI 150# RF			
			N-131	NITROGEN GAS SUPPLY	3/4" ANSI 3000 RF
V-131	OIL RESERVOIR VENT	1" ANSI 150# RF			
ST-131	TURBINE STEAM INLET	3" ANSI 300# RF			
ST-132	TURBINE STEAM EXHAUST	3" ANSI 150# RF			
ST-133	GOVERNOR VALVE LEAK	3/4" ANSI 3000 RF			
ST-134	EMERGENCY GLAND LEAK	3/4" ANSI 3000 RF			
ST-135	RESERVOIR HEATER STEAM INLET	3/4" ANSI 3000 RF			
ST-136	RESERVOIR HEATER STEAM OUTLET	3/4" ANSI 3000 RF			
			E-131	MOTOR CABLE ENTRY	
D-131	DRAIN FOR STEAM TURBINE	2" ANSI 150# RF	E-141	JB-41 CONN.	
IA-131	INSTRUMENT AIR SUPPLY	3/4" ANSI 3000 RF			

LG E&G

INSPECTION TEAM
☑ WITNESSED ☐ REVIEWED
Oct 20 '03

ELLIOTT EBARA GROUP

☑ Witnessed
☐ Reviewed

EETC Q.C Dept. Oct, 30, '03

MISUZU Industrial Corporation

H. Tanaka

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MISUZU

INSPECTION REPORT

CUSTOMER : ELLIOTT EBARA TURBO MACHINERY CORPORATION	EBARA SER. NO. : R021570804
ARTICLE : LUBE OIL CONSOLE UNIT	ITEM NO. : CT-9901/TC-9901
ITEM : COOLER	SERIAL NO. : U-2549
DRAWING NO. : ER021570804/902 (K1-01692)	INSPECTION DATE : 30th OCT. 2003

CUSTOMER : LG ENGINEERING & CONSTRUCTION CORP.

FINAL USER : TURKISH PETROLEUM REFINERIES CORP.

PROJECT : TUPRAS IZMIR REFINERY DHP PROJECT

JOB. NO. : 7020

SERVICE : RECYCLE GAS COMPRESSOR

ITEM NO. CT-9901E1A/E1B

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed

EETC Q.C Dept.

Certified by :

Inspected by : H. Tanaka

MISUZU Industrial Corporation

FORM U-1 MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS
As Required by the Provisions of the ASME Code Rules, Section VIII, Division 1

1. Manufactured and certified by: DONG-HWA Entec 1575-6 Songjeong-Dong, Gangseo-Gu, PUSAN, KOREA,618-270 (Name and address of Manufacturer)

2. Manufactured for: EBARA CORPORATION (Name and address of Purchaser)

3. Location of installation: N/A (Name and address)

4. Type: HORIZ. (Horiz., ~~vert., or sphere~~) | heat exh. (~~Form, separator, jkt. vessel~~, heat exh., ~~etc.~~) | E50740-A (Mfg's serial No.)

N/A (CRN) | DHPF-D00-0096-01 Rev. 1 (Drawing No.) | N/A (Nat'l Bd. No.) | 2003 (Year built)

5. ASME Code, Section VIII, Div.1 | 2001ED. 2002ADD. (Edition and Addenda (date)) | N/A (Code Case No.) | N/A (Special Service per UG-120(d))

Items 6-11 incl. to be completed for single wall vessels, jackets of jacketed vessels, shell of heat exchangers, or chamber of multi-chamber vessels.

6. Shell (a) No. of course(s): 1 (b) Over all length (ft & in.): 8'-2.076"

Course(s)			Material	Thickness		Long Joint (Cat. A)			Circum Joint (Cat. A,B & C)			Heat Treatment	
No.	Dimater, in	Length (ft & in)	Spec./Grade or Type	Nom.	Corr.	Type	Full, Spot, None	Eff.	Type	Full, Spot, None	Eff.	Temp.	Time
1	1'-1.127"	8'-2.076"	SA106-B	0.437"	0.126"	S	NONE	1	7	NONE	N/A	N/A	N/A
2													

7. Heads: (a) N/A (Mat'l Spec. No., Grade or Type) H.T. - Time & Temp. (b) N/A (Mat'l Spec. No., Grade or Type) H,T. - Time & Temp.

	Location (Top, Bottom, Ends)	Thickness		Radious		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure		Category A		
		Min.	Corr.	Crown	Knuckle					Convix	Concave	Type	Full,spot, None	Eff.
(a)														
(b)														

If removable, bolts used (describe other fastening) N/A (Mat'l Spec. No. Grade, size, No.)

8. Type of jacket: N/A Jacket closure: N/A (Describe as ogee & weld, bar, etc)

If bar, give dimensions: N/A If bolted, describe or sketch.

9. MAWP 312.9 (internal) N/A (external) Psi at max. temp 194 (internal) N/A (external) °F Min. design metal temp. 28.4 °F at 312.9 Psi

10. Impact test: NO (EXEMPTED BY UG-20(f)) (Indicate yes or no and the component(s) impact tested)

11. Hydro. test press. 469.40 Psi Proof test: N/A

Items 12 and 13 to be completed for tube sections.

12. Tubesheet:

SB171-C46400 (Stationary(Mat'l Spec. No.))	1'-4.654" (Dia., in(subject to press.))	1.654" (Nom. thk., in)	N/A (Corr.Allow.,in)	through (Attachment (welded or bolted))
SB171-C46400 (Floating(Mat'l Spec. No.))	1'-0.859" (Dia., in)	1.654" (Nom. thk., in)	N/A (Corr.Allow.,in)	through (Attachment)

13. Tube:

SB111-C44300 (Mat'l Spec. No. Grade or Type)	0.750" (OD, in)	0.083" (Nom. thk., in. or gauge)	104 (Number)	Straight (Type(Straight or U))

Items 14-18 inc. to be completed for inner chambers of jacketed vessels or channels of heat exchangers.

14. Shell (a) No. of course(s): 2 (b) Over all length (ft & in.): 2'-1.316"

Course(s)			Material	Thickness		Long Joint (Cat. A)			Circum Joint (Cat. A,B & C)			Heat Treatment	
No.	Dimater, in	Length (ft & in)	Spec./Grade or Type	Nom.	Corr.	Type	Full, Spot, None	Eff.	Type	Full, Spot, None	Eff.	Temp.	Time
1	1'-1.127"	1'-3.473"	SA106-B	0.437"	0.118"	S	NONE	1	N/A	NONE	N/A	N/A	N/A
2	1'-1.127"	9.843"	SA106-B	0.437"	0.118"	S	NONE	1	N/A	NONE	N/A	N/A	N/A

15. Heads: (a) SA105, No PWHT (Mat'l Spec. No., Grade or Type) H.T. - Time & Temp. (b) SA105, No PWHT (Mat'l Spec. No., Grade or Type) H,T. - Time & Temp.

	Location (Top, Bottom, Ends)	Thickness		Radious		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure		Category A		
		Min.	Corr.	Crown	Knuckle					Convix	Concave	Type	Full,spot, None	Eff.
1	Right End	1.575"	0.118"	N.A	N/A	N/A	N/A	N/A	1'-7.804"	N/A	128	N/A	N/A	N/A
2	Left End	1.575"	0.118"	N.A	N/A	N/A	N/A	N/A	1'-7.804"	N/A	128	N/A	N/A	N/A

If removable, bolts used (describe other fastening SA193-B7, M20 x 135L , 16EA / EACH (Mat'l Spec. No. Grade, size, No.)

CT-990/E1A

2001 SECTION VIII - DIVISION 1

FORM U-1 (Back)

16. MAWP 128 (internal) N/A (external) Psi at max. temp 248 (internal) N/A (external) °F Min. design metal temp. 28.4 °F at 128 Psi

17. Impact test NO (EXEMPTED BY UG-20(f))
(indicate yes or no and the component(s) impact tested)

18. Hydro. test press. 192 Psi Proof test N/A

19. Nozzles, inspection. and safety valve openings ; See Attached U-4 Form

Purpose (Inlet,Drain, Etc)	No.	Diameter or Size	Flange Type	Material		Nozzle Thick ness		Reinforcement Material	How Attached		Location (Insp. Open)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
Oil inlet (S1A)	1	2"	Cl.300 lwn.	SA105	SA105	0.654"	0.126"	N/A	Welded. Fig. UW-16©		
Oil outlet (S2A)	1	2"	Cl.300 lwn.	SA105	SA105	0.654"	0.126"	N/A	Welded. Fig. UW-16©		
Vent (S3A)	1	3/4"	Cl.300 lwn.	SA105	SA105	0.567"	0.126"	N/A	Welded. Fig. UW-16(a)		
Drain (S4A)	1	3/4"	Cl.300 lwn.	SA105	SA105	0.567"	0.126"	N/A	Welded. Fig. UW-16(a)		
Water inlet (T1A)	1	2"	Cl.150 lwn.	SA105	SA105	0.626"	0.118"	N/A	Welded. Fig. UW-16©		
Water Outlet (T2A)	1	2"	Cl.150 lwn.	SA105	SA105	0.626"	0.118"	N/A	Welded. Fig. UW-16©		
Vent (T3A)	1	3/4"	Cl.150 lwn.	SA105	SA105	0.374"	0.118"	N/A	Welded. Fig. UW-16(a)		
Drain (T4A)	1	3/4"	Cl.150 lwn.	SA105	SA105	0.374"	0.118"	N/A	Welded. Fig. UW-16(a)		

20. Supports : Skirt No (Yes or No) Lugs N/A (no.) legs N/A (No.) Others Saddle (Describe) Attached Welded to Shell (Where and how)

21. Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for following items of the report;
(List the name of part, item number, mfg's. name and identifying number)

N/A

22. Remarks;

1.ITEM No. : CT-9901E1A
2. INSPECTION OPENING HOLE WAS EXEMPTED PER UG-45(a)
3. SAFETY VALVE IS OWNER SCOPE

CERTIFICATE OF SHOP COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME Code for Pressure Vessels, Section VIII, Division 1.

U Certificate of Authorization No. 26,012 Expires OCT. 14th. 2003

Date Sep. 08, 2003 Name Donghwa Entec. (Manufacturer) Signed

CERTIFICATE OF SHOP INSPECTION

I, The undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of VERMONT and employed by ABS Consulting. of HUSTON, TX. USA have inspected the pressure vessel described in this Manufacturer's Data Report on Feb. 23TH. 2000 . and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME Code, Section VIII, Division 1. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report, Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection,

Date Nov 6 '03 Signed (Authorized inspector) Commissions VT-1198 (Nat'l Board-incl. endorsement,State.Province and No.)

CERTIFICATE OF FIELD ASSEMBLY COMPLIANCE

We certify that the statementson this report are correct and that the field assembly construction of all parts of this vessel conforms with the requirements of ASME Code, Section VIII, Division 1.

U Certificate of Authorization No. Expires

Date Name (Assembler) Signed (Representative)

CERTIFICATE OF FIELD ASSEMBLY INSPECTION

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or province of and employed by of have compared the statements in this Manufacturer's Data Report with the described pressure vessel and state that parts referred to as data items , not included in the certificate of shop inspection, have been inspected by me and to the best of my knowledge and belief, the Manufacturer has constructed and assembled this pressure vessel in accordance with ASME Code, Section VIII, Division 1. The described vessel was inspected and subjected to a hydrostatic test of psi. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied ,concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date Signed (Authorized inspector) Commissions (Nat'l Board-incl. endorsement,State.Province and No.)

CT-9901E1A

FORM U-1 MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS
As Required by the Provisions of the ASME Code Rules, Section VIII, Division 1

1. Manufactured and certified by: DONG-HWA Entec 1575-6 Songjeong-Dong, Gangseo-Gu. PUSAN, KOREA,618-270 (Name and address of Manufacturer)

2. Manufactured for: EBARA CORPORATION (Name and address of Purchaser)

3. Location of installation: N/A (Name and address)

4. Type: HORIZ. (Horiz., ~~vert., or sphere~~) | heat exh. (~~Tank, separator, jkt. vessel~~, heat exh., ~~etc.~~) | E50740-B (Mfg's serial No.)

N/A (CRN) | DHPF-D00-0096-01 Rev. 1 (Drawing No.) | N/A (Nat'l Bd. No.) | 2003 (Year built)

5. ASME Code, Section VIII, Div.1 | 2001ED. 2002ADD. (Edition and Addenda (date)) | N/A (Code Case No.) | N/A (Special Service per UG-120(d))

Items 6-11 incl. to be completed for single wall vessels, jackets of jacketed vessels, shell of heat exchangers, or chamber of multi-chamber vessels.

6. Shell (a) No. of course(s): 1 (b) Over all length (ft & in.): 8'-2.076"

Course(s)			Material	Thickness		Long Joint (Cat. A)			Circum Joint (Cat. A,B & C)			Heat Treatment	
No.	Dimater, in	Length (ft & in)	Spec./Grade or Type	Nom.	Corr.	Type	Full, Spot, None	Eff.	Type	Full, Spot, None	Eff.	Temp.	Time
1	1'-1.127"	8'-2.076"	SA106-B	0.437"	0.126"	S	NONE	1	7	NONE	N/A	N/A	N/A
2													
3													

7. Heads: (a) N/A (Mat'l Spec. No., Grade or Type) H.T. - Time & Temp. (b) N/A (Mat'l Spec. No., Grade or Type) H.T. - Time & Temp.

	Location (Top, Bottom, Ends)	Thickness		Radious		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure		Category A		
		Min.	Corr.	Crown	Knuckle					Convix	Concave	Type	Full,spot, None	Eff.
(a)														
(b)														

If removable, bolts used (describe other fastening) N/A (Mat'l Spec. No. Grade, size. No.)

8. Type of jacket: N/A Jacket closure: N/A (Describe as ogee & weld. bar. etc)

If bar, give dimensions: N/A If bolted, describe or sketch.

9. MAWP 312.9 (internal) N/A (external) Psi at max. temp 194 (internal) N/A (external) °F Min. design metal temp. 28.4 °F at 312.9 Psi

10. Impact test: NO (EXEMPTED BY UG-20(f)) (Indicate yes or no and the component(s) impact tested)

11. Hydro. test press. 489.40 Psi Proof test N/A

Items 12 and 13 to be completed for tube sections.

12. Tubesheet:

SB171-C46400 (Stationary(Mat'l Spec. No.))	1'-4.654" (Dia., in(subject to press.))	1.654" (Nom. thk., in)	N/A (Corr.Allow.,in)	through (Attachment (welded or bolted))
SB171-C46400 (Floating(Mat'l Spec. No.))	1'-0.859" (Dia., in)	1.654" (Nom. thk., in)	N/A (Corr.Allow.,in)	through (Attachment)

13. Tube:

SB111-C44300 (Mat'l Spec. No. Grade or Type)	0.750" (OD, in)	0.083" (Nom. thk., in. or gauge)	104 (Number)	Straight (Type(Straight or U))

Items 14-18 inc. to be completed for inner chambers of jacketed vessels or channels of heat exchangers.

14. Shell (a) No. of course(s): 2 (b) Over all length (ft & in.): 2'-1.316"

Course(s)			Material	Thickness		Long Joint (Cat. A)			Circum Joint (Cat. A,B & C)			Heat Treatment	
No.	Dimater, in	Length (ft & in)	Spec./Grade or Type	Nom.	Corr.	Type	Full, Spot, None	Eff.	Type	Full, Spot, None	Eff.	Temp.	Time
1	1'-1.127"	1'-3.473"	SA106-B	0.437"	0.118"	S	NONE	1	N/A	NONE	N/A	N/A	N/A
2	1'-1.127"	9.843"	SA106-B	0.437"	0.118"	S	NONE	1	N/A	NONE	N/A	N/A	N/A

15. Heads: (a) SA105, No PWHT (Mat'l Spec. No., Grade or Type) H.T. - Time & Temp. (b) SA105, No PWHT (Mat'l Spec. No., Grade or Type) H,T. - Time & Temp.

	Location (Top, Bottom, Ends)	Thickness		Radious		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure		Category A		
		Min.	Corr.	Crown	Knuckle					Convix	Concave	Type	Full,spot, None	Eff.
1	Right End	1.575"	0.118"	N.A	N/A	N/A	N/A	N/A	1'-7.804"	N/A	128	N/A	N/A	N/A
2	Left End	1.575"	0.118"	N.A	N/A	N/A	N/A	N/A	1'-7.604"	N/A	128	N/A	N/A	N/A

If removable, bolts used (describe other fastening SA193-B7, M20 x 135L , 16EA /EACH (Mat'l Spec. No. Grade, size No.)

CT-99 01 E1B

2001 SECTION VIII - DIVISION 1

FORM U-1 (Back)

16. MAWP 128 (internal) N/A (external) Psi at max. temp 248 (internal) N/A (external) °F Min. design metal temp. 28.4 °F at 128 Psi

17. Impact test NO (EXEMPTED BY UG-20(f)
(indicate yes or no and the component(s) impact tested)

18. Hydro. test press. 192 Psi Proof test N/A

19. Nozzles, inspection. and safety valve openings ; See Attached U-4 Form

Purpose (inlet,Drain, Etc)	No.	Diameter or Size	Flange Type	Material		Nozzle Thick ness		Reinforcement Material	How Attached		Location (Insp. Open)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
Oil inlet (S1B)	1	2"	Cl.300 lwn.	SA105	SA105	0.654"	0.126"	N/A	Welded. Fig. UW-16©		
Oil outlet (S2B)	1	2"	Cl.300 lwn.	SA105	SA105	0.654"	0.126"	N/A	Welded. Fig. UW-16©		
Vent (S3B)	1	3/4"	Cl.300 lwn.	SA105	SA105	0.567"	0.126"	N/A	Welded. Fig. UW-16(a)		
Drain (S4B)	1	3/4"	Cl.300 lwn.	SA105	SA105	0.567"	0.126"	N/A	Welded. Fig. UW-16(a)		
Water inlet (T1B)	1	2"	Cl.150 lwn.	SA105	SA105	0.626'	0.118"	N/A	Welded. Fig. UW-16©		
Water Outlet (T2B)	1	2"	Cl.150 lwn.	SA105	SA105	0.626"	0.118"	N/A	Welded. Fig. UW-16©		
Vent (T3B)	1	3/4"	Cl.150 lwn.	SA105	SA105	0.374"	0.118"	N/A	Welded. Fig. UW-16(a)		
Drain (T4B)	1	3/4"	Cl.150 lwn.	SA105	SA105	0.374"	0.118"	N/A	Welded. Fig. UW-16(a)		

20. Supports : Skirt No (Yes or No) Lugs N/A (no.) legs N/A (No.) Others Saddle (Describe) Attached Welded to Shell (Where and how)

21. Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for following items of the report;
(List the name of part, item number, mfg's. name and identifying number)

N/A

22. Remarks;

1.ITEM No. : CT-9901E1B
2. INSPECTION OPENING HOLE WAS EXEMPTED PER UG-46(a)
3. SAFETY VALVE IS OWNER SCOPE

CERTIFICATE OF SHOP COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME Code for Pressure Vessels, Section VIII, Division 1.
U Certificate of Authorization No. 26,012 Expires OCT. 14th. 2003

Date Sep. 06, 2003 Name DongHwa Entec. (Manufacturer) Signed

CERTIFICATE OF SHOP INSPECTION

I, The undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel inspectors and/or the State or Province of VERMONT and employed by ABS Consulting. of HUSTON, TX. USA have inspected the pressure vessel described in this Manufacturer's Data Report on Feb. 23TH. 2000 . and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME Code, Section VIII, Division 1. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report, Furthermore, neither the inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection,

Date Nov. 6 '03 Signed (Authorized Inspector) Commissions VT-678 (Nat'l Board-incl. endorsement,State.Province and No.)

CERTIFICATE OF FIELD ASSEMBLY COMPLIANCE

We certify that the statementson this report are correct and that the field assembly construction of all parts of this vessel conforms with the requirements of ASME Code, Section VIII, Division 1.
U Certificate of Authorization No. Expires

Date Name (Assembler) Signed (Representative)

CERTIFICATE OF FIELD ASSEMBLY INSPECTION

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel inspectors and/or the State or province of and employed by of have compared the statements in this Manufacturer's Data Report with the described pressure vessel and state that parts referred to as data items . not included in the certificate of shop inspection, have been inspected by me and to the best of my knowledge and belief, the Manufacturer has constructed and assembled this pressure vessel in accordance with ASME Code, Section VIII, Division 1. The described vessel was inspected and subjected to a hydrostatic test of psi. By signing this certificate neither the inspector nor his employer makes any warranty, expressed or implied ,concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date Signed (Authorized Inspector) Commissions (Nat'l Board-incl. endorsement,State.Province and No.)

CT-9901E1B

DongHwa Entec

TABULATION OF MATERIAL (1/2)

PROJECT NAME	TUPRAS IZMIR DHP PJT	CUSTOMER	EBARA CORPORATION
ITEM NAME	OIL COOLER	DHE Job No.	E50740-A/B
ITEM NO.	CT-9901E1A/E1B	DATE	2003. 9 . 2 .

DWG. NO.	PART NO.	Description	Material SPEC.	Heat/Plate/ Charge No.	Page	Q'TY
DHPA-D00-0096-02	1	SHELL	SA106-B (14" SCH.40)	J1LA9149	1-2	1 EA
	2	CHANNEL	SA106-B (14" SCH.40)	J1LA9149	1-2	1 EA
	3	CHANNEL	SA106-B (14" SCH.40)	J1LA9149	1-2	1 EA
	4	SHELL FLANGE	SA105 (t55)	Y63583	3	1 EA
	5	SHELL FLANGE	SA105 (t55)	Y63583	3	1 EA
	6	CHANNEL FLANGE	SA105 (t55)	Y63583	3	1 EA
	7	CHANNEL FLANGE	SA105 (t47)	Y63583	3	2 EA
	8	CHANNEL FLANGE	SA105 (t55)	Y63583	3	1 EA
	9	CHANNEL COVER FLANGE	SA105 (t40)	Y63583	3	1 EA
	10	CHANNEL COVER FLANGE	SA105 (t40)	Y63583	3	1 EA
DHPA-D00-0096-03	1	SHELL	SA106-B (14" SCH.40)	J1LA9149	1-2	1 EA
	2	CHANNEL	SA106-B (14" SCH.40)	J1LA9149	1-2	1 EA
	3	CHANNEL	SA106-B (14" SCH.40)	J1LA9149	1-2	1 EA
	4	SHELL FLANGE	SA105 (t55)	Y63583	3	1 EA
	5	SHELL FLANGE	SA105 (t55)	Y63583	3	1 EA
	6	CHANNEL FLANGE	SA105 (t55)	Y63583	3	1 EA
	7	CHANNEL FLANGE	SA105 (t47)	Y63583	3	2 EA
	8	CHANNEL FLANGE	SA105 (t55)	Y63583	3	1 EA
	9	CHANNEL COVER FLANGE	SA105 (t40)	Y63583	3	1 EA
	10	CHANNEL COVER FLANGE	SA105 (t40)	Y63583	3	1 EA
DHPA-D00-0096-04	1	TUBE	SB111-C44300 (O.D19.05x2.11t-2600L)	030521-4L	5	104 EA

PREPARED BY	Y.T.JEONG	WITNESSED BY	Adopted ASME Code (Ed. ED, or Add) ABS ASME A1
APPROVED BY	H.I.AHN		

DongHwa Entec

TABULATION OF MATERIAL (2/2)

PROJECT NAME	TUPRAS IZMIR DHP PJT	CUSTOMER	EBARA CORPORATION
ITEM NAME	OIL COOLER	DHE Job No.	E50740-A/B
ITEM NO.	CT-9901E1A/E1B	DATE	2003. 9. 7.

DWG. NO.	PART NO.	Description	Material SPEC.	Heat/Plate/ Charge No.	Page	Q'TY
DHPA-D00-0096-04	2	TUBE SHEET	SB171-C46400 (t42)	030618-6	6	1 EA
	3	TUBE SHEET	SB171-C46400 (t42)	030618-6	6	1 EA
DHPA-D00-0096-05	1	TUBE	SB111-C44300 (O.D19.05x2.11t-2600L)	030521-4L	5	104 EA
	2	TUBE SHEET	SB171-C46400 (t42)	030618-6	6	1 EA
	3	TUBE SHEET	SB171-C46400 (t42)	030618-6	6	1 EA
DHPA-D00-0096-06	16	FLANGE	SA105 (2" ANSI 150# LWN.RF)	Y63583	3	2 EA
	17	FLANGE	SA105 (2" ANSI 150# LWN.RF)	Y63583	3	2 EA
	18	FLANGE	SA105 (3/4" ANSI 150# LWN.RF)	Y63583	3	2 EA
	19	FLANGE	SA105 (3/4" ANSI 150# LWN.RF)	Y63583	3	2 EA
DHPA-D00-0096-07	1	FLANGE	SA105 (2" ANSI 300# LWN.RF)	Y63583	3	2 EA
	2	FLANGE	SA105 (2" ANSI 300# LWN.RF)	Y63583	3	2 EA
	3	FLANGE	SA105 (3/4" ANSI 300# LWN.RF)	Y63583	3	2 EA
	4	FLANGE	SA105 (3/4" ANSI 300# LWN.RF)	Y63583	3	2 EA
	5	BOSS	SA105 (NPT 3/4" ANSI 3000#)	Y52631	4	2 EA
			BLANK			

PREPARED BY	Y.T.JEONG	**WITNESSED BY**	ABS ASME AI
APPROVED BY	H.J.AHN		

E50740

A S M E

PAGE NO. 14

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES, LTD.
WAKAYAMA STEEL WORKS
1850, MINATO, WAKAYAMA, JAPAN

CERTIFICATE NO. : WYYK1725 PAGE: 1 DATE: 2001-10-31

CUSTOMER :SAM ICK STEEL CO.
ORDER NO. :
SHIPPER :SUMIKIN BUSSAN CORPORATION 056 116 HCK1387 1P170430418
COMMODITY :SEAMLESS HOT FINISHED CARBON STEEL PIPE WITH BEVELED ENDS

STANDARD :API 5L GR.B ASTM A106-99 / ASME 1998(A00) SA-106 GR.B
ASTM A53-99B / ASME 1998(A00) SA-53 GR.B

SPECIFICATION

MILL WORK NO. :WYYK1725 O.D. :NB14 W.T. :SCH40 LENGTH:6000mm QUANTITY:53pcs. MASS:3005lkg

HEAT NO	PRODUCTS PCS.	HEAT NO.	PRODUCTS PCS.	HEAT NO.	PRODUCTS PCS.	HEAT NO.	PRODUCTS PCS
J1KA191	4	J1L9147	9	J1L9149	36	J1L9158	1

HEAT TREATMENT:AS ROLLED

CHEMICAL COMPOSITION(%)

	*1	C	Si	Mn	P *2	S *2	Cu	Cr	Ni	Mo	V	*U4
SPEC. MIN.	L	-	10	29	-	-	-	-	-	-	-	-
MAX.	L	27	-	106	30	30	40	40	40	15	8	100
MIN.	P	-	10	29	-	-	-	-	-	-	-	-
MAX.	P	30	-	106	35	35	40	40	40	15	8	100
HEAT NO.												
J1KA191	L	19	20	75	19	9	1	6	2	1	0	10
	P	20	21	74	19	8	1	6	2	1	0	10
	P	20	20	75	19	8	1	6	2	1	0	10
J1L9147	L	19	20	56	16	8	1	5	2	0	0	8
	P	20	19	56	15	9	1	5	2	0	0	8
	P	20	19	55	13	8	1	5	2	0	0	8
J1L9149	L	19	19	55	12	9	1	4	2	0	0	7
	P	21	19	56	14	10	1	5	2	0	0	8
	P	20	19	55	12	8	1	4	2	0	0	7
J1L9158	L	18	21	66	11	6	1	5	2	1	0	9
	P	20	21	65	11	6	1	5	2	1	0	9
	P	20	21	66	12	6	1	5	2	1	0	9

*1 L:LADLE ANALYSIS
P:PRODUCT ANALYSIS

*2: X1000
OTHER:X100

*U4:Cu+Ni+Cr+Mo+V

RECEIVING INSPECTION RECORD

W/O NO.: E50740	RIR NO. : E50740-01
P/O NO. : -	POS NO. : -
RESULT : Accept.	REMARK : -
PREPARED BY : Q.C INSP.	APPROVED BY : Q.C SECT. CHIEF

We certify that the above material is Identical with SA 106 of Adopted Ed. & Add. of ASME Sec. II

01ED. 02A00.

TENSILE TEST

	*1	*2	YS *3	TS *3	EL %
SPEC. MIN.	T	B	P 35.0	P 60.0	29.0
MAX.	T	B	P -	P -	-
HEAT NO.					
J1KA191	T	B	P 42.4	P 70.0	41.7
J1L9147	T	B	P 44.0	P 66.1	36.9
J1L9149	T	B	P 41.1	P 68.5	40.9
J1L9158	T	B	P 44.4	P 66.5	38.2

TYPE OF SPECIMEN
PLATE 1-1/2" 38mm)
WIDTH
GAUGE LENGTH
2.0"
KIND OF YS
0.5% EXTENSION UNDER LOAD
*1 DIRECTION
T:TRANSVERSE
*2 SAMPLING POSITION
B:BASE METAL
*3 UNIT
P:ksi

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN DESCRIBED HAS BEEN MANUFACTURED, SAMPLED, TESTED, AND INSPECTED IN ACCORDANCE WITH ABOVE STANDARD AND SPECIFICATION AND SATISFIES THE REQUIREMENTS.

ABS
ASME AI

MANAGER, TUBULAR PRODUCTS QUALITY CONTROL SECTION

INSPECTION CERTIFICATE A S M E

SUMITOMO METAL INDUSTRIES, LTD.
WAKAYAMA STEEL WORKS
1850, MINATO, WAKAYAMA, JAPAN

PAGE NO. 15

CERTIFICATE NO. : WYYK1725 PAGE: 2 DATE: 2001-10-31

MAKE MEDIUM HARDNESS :HRC 22 MAX. :GUARANTEED
FLATTENING TEST:ACCEPTABLE
VISUAL & DIMENSIONS:ACCEPTABLE
HYDROSTATIC TEST 1310psi:ACCEPTABLE

NO WELD REPAIR

RECEIVING INSPECTION RECORD

W/O NO.: E50740	RIR NO.: E50740-01
P/O NO.: ~	POS NO.: ~
RESULT: Accept	REMARK: ~
PREPARED BY: Q.C INSP.	APPROVED BY: Q.C SECT. CHIEF
We certify that the above material is identical with SA 106 of Adopted Ed. & Add. of ASME Sec. II.	

ABS ASME AI

01ED, 02ADD.

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN DESCRIBED HAS BEEN MANUFACTURED, SAMPLED, TESTED, AND INSPECTED IN ACCORDANCE WITH ABOVE STANDARD AND SPECIFICATION AND SATISFIES THE REQUIREMENTS.

月下嘉蔵

MANAGER, TUBULAR PRODUCTS QUALITY CONTROL SECTION

YOUNG CHANG MACHINERY CO.,LTD
452-2,MangDeok-Ri,Juchon-Myun,KimHae,KyungNam,KOREA
TEL: (82-55) 323-1595(代)
FAX: (82-55) 323-1598

(E50R40)

CERTIFICATE OF MATERIAL

Job No : 1-200307-29
Report No : 200307-312-29
Date : 2003.07.29.

Customer	㈜동화엔텍	Name of Article	FORGED STEEL	Heat Treatment

Material		C	Si	Mn	P	S	Ni	Cr	Mo	Cu	V	Nb	Al	Heat Treatment
ASME SEC II PART"A"SA105 01ED		0.35 max	0.10 0.35	0.60 1.05	0.035 max	0.040 max	0.40 max	0.30 max	0.12 max	0.40 max	0.05 max	0.02 max		N:880CX6.5HRS A.C
Charge No	Y63583	0.21	0.23	0.80	0.015	0.003	0.01	0.02	TR	TR	0.001	TR	0.010	

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Type of Test / Spec imen No	Tension Test: Specimen Dia	Gage Length	Y.S (Mpa)	T.S (Mpa)	EL %	Red. of Area	Charpy Impact Test: Individual	Average	Notch Type	Hardness (HB) HS HR	Bending Test
							min		–		
	12.5	50.0	250 min	485 min	22 min	30 min		Average	Temp	187	
YC-234	12.5	50.0	318.0	520.0	34.0	59.0				145	

상기 성적을 제출된 지료에 한하며
선정 및 수술에는 사용할 수 없음
Test Result 없음

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Dimensional Inspection	Good
Ultrasonic Examination	Good
Magnetic Examination	N/A

Dimension or Drawing No :

- 55T X 503 X 357 ------- 4EA
- 47T X 503 X 357 ------- 4EA
- * 30T X 503 X 329 ------- 2EA
- 150LBS LWNRF 188.5L 2" ------- 4EA
- * 300LBS LWNRF 260.7L 2" ------- 4EA
- * 55T X 503 X 329 -------- 4EA
- * 40T X 503 -------------- 4EA
- * 150LBS LWNRF 173.2L 3/4" -------- 4EA
- * 300LBS LWNRF 173.8L 3/4" -------- 4EA

RECEIVING INSPECTION RECORDS
W/O NO.: E50R40 RIR NO.: E50R40-02
P/O NO.: – POS NO.:
RESULT: Accept REMARK: –
PREPARED BY: [signature] Q.C INSP. APPROVED BY: Q.C SECT. CHIEF
We certify that the above material is identical with SA 105 of Adopted Ed. & Add. of ASME Sec. II 01ED. 02ADD.

F.M.– Final Machined	S.T. – Solution Treatment	W.C. – Water Cool
R.M.– Rough Machined	A. – Anneald	O.C. – Oil Cool
A.F. – As Forged	N. – Normalized	A.C. – Air Cool
H.T. – Heat Treated	L. – Longitudinal Direction	F.C. – Furnace Cool
Q.T. – Quenched & Tempered	T. – Tangential Direction	N.A. – Non Action
N.T. – Normalized & Tempered	R. – Radial Direction	Ceq.– Carbon Equivalent

We hereby certify that the material herein has been made and tested in accordance with the above specification and also with the requirements called for by the above order.

ABS ASME AI

Witnessed by

7/29
Chief of Quality Control Sec.

ASME

PAGE NO 3

(E50R40)

CERTIFICATE OF MATERIAL

YOUNG CHANG MACHINERY CO.,LTD
452-2,MangDeok-Ri,Juchon-Myun,KimHae,KyungNam,KOREA
TEL: (82-55) 323-1595(代)
FAX: (82-55) 323-1598

Job No : 1-200308-814
Report No : 200308-223-123
Date : 2003.08.15.

Customer	㈜동화엔텍	Name of Article	FORGED STEEL	Heat Treatment

Material	C	Si	Mn	P	S	Ni	Cr	Mo	Cu	V	Nb	Al	Heat Treatment
ASME SEC II PART"A"SA105 01ED	0.35 max	0.10 0.35	0.60 1.05	0.035 max	0.040 max	0.40 max	0.30 max	0.12 max	0.40 max	0.05 max	0.02 max		N:880CX6.5HRS A.C
Charge No Y52631	0.21	0.22	0.80	0.014	0.004	0.01	0.02	TR	TR	0.001	TR	0.010	

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Type of Test / Spec imen No	Specimen Dia	Specimen Gage Length	Tension Test Y.S (Mpa)	Tension Test T.S (Mpa)	EL %	Red. of Area %	Charpy Impact Test Individual	Average	Notch Type	Hardness (HB) HS HR	Bending Test
	12.5	50.0	250 min	485 min	22 min	30 min	min. -			187	
							Test Result	Average	Temp		
YC-441	12.5	50.0	319.0	519.0	34.0	59.0				143	

상기 청석은 ... 하하며 신전 및 소송 ... 수 없음

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Dimensional Inspection	Good
Ultrasonic Examination	Good
Magnetic Examination	N/A

Dimension or Drawing No :
* BOSS 35 X 50L ----- 2EA

RECEIVING INSPECTION RECORD

W/O NO. : E50R40	ROT NO. : E50R40-03
P/O NO. : \	POS NO. : \
RESULT : Accept.	REMARK : \
PREPARED BY : Q.C INSP.	APPROVED BY : Q.C SECT. CHIEF

We certify that the above material is identical with SA-105 of Adopted Ed. & Add. of ASME Sec. II 01ED, 02ADD.

ABS ASME AI

F.M.- Final Machined	S.T. - Solution Treatment	W.C. - Water Cool
R.M.- Rough Machined	A. - Anneald	O.C. - Oil Cool
A.F. - As Forged	N. - Normalized	A.C. - Air Cool
H.T. - Heat Treated	L. - Longitudinal Direction	F.C. - Furnace Cool
Q.T. - Quenched & Tempered	T. - Tangential Direction	N.A. - Non Action
N.T. - Normalized & Tempered	R. - Radial Direction	Ceq.- Carbon Equivalent

We hereby certify that the material herein has been made and tested in accordance with the above specification and also with the requirements called for by the above order.

Witnessed by

8/14
Chief of Quality Control Sec.

ASME

PAGE NO 4

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CUSTOMER : 동화엔텍

SUPPLIER : YANG BO CO., LTD.

SALES CONTRACT NO.: E501400 외

TYPE OF METAL : Admiralty Metals, B, C, and D

SPECIFICATION : ASME SB111 C44300-061

MILL CERTIFICATE

CERT. NO.: 30811-1

YANG BO CO., LTD.
#1506-1, Songjeong-Dong,
Gangseo-Gu, Busan, Korea

Lot No.	SIZE			Q'TY		Dimension	Surface	Nondestructive Test		Mercurous Nitrate	Heat Treatment
	OD	WT	LENGTH	Kgs	Pcs			ECT	HYDRO.		
030521-4L	19.05	2.11	2600		208	good	good	good		good	600℃ 25min
030521-4L	19.05	2.11	1400		54	good	good	good		good	

RECEIVING INSPECTION RECORD
W/O NO. : E501400 R/I NO. : E501400-04
P/O NO. : - PCS NO. : -
RESULT : Accept REMARK : -
PREPARED BY : Q.C INSP. APPROVED BY : Q.C SECT. CHIEF
We certify that the above material is identical with SB111 of Adopted Ed. & Add. of ASME Spec.
OKED. 02ADD

Lot No.		Chemical Composition (%)						
		Cu	Pb	Fe	Zn	Mn	As	Sn
Spec	MIN.	70.00	–	–	rem	–	0.02	0.9
	MAX.	73.00	0.07	0.06	rem	–	0.06	1.20
030521-4L		71.59	0.030	0.012	rem	–	0.043	1.133

Test		Tensile Properties			Hardness	Grain Size	Flattening Test	ABS Expansion Test ASME AI
		T.S. (KSI)	Y.S.(0.2%) (KSI)	EL. (%)	Body HV			
Spec	MIN.	45	15	40	–	0.010		
	MAX.	–	–	–	–	0.045		
19.05 X 2.11 X 2600		54.5	24.9	–	–	0.025	good	good
19.05 X 2.11 X 1400		53.49	24.55	–	–	0.025	good	good

L/C No. and date :

We here by certify that the material described above has been tested and complies with the terms of the order contract.

J. B. Kim

Quality Manager Team Manager

DATE : 11-Aug-03

ASME

CERTIFICATE OF INSPECTION & TEST

#491 SIN PYEONG-DONG,
SAHA-GU, BUSAN, KOREA
TEL:(051) 293-4423 (REP), FAX:(051) 293-4433
ISO 9001 KOREA TRADING & INDUSTRIES CO.,LTD.
METAL PRODUCT DIVISION

CUSTOMER	DONG HWA ENTEC CO.,LTD.	REPORT NO.	KQA-030718-3
APPLICABLE CODE / ITEM	ASTM B171 / NAVAL BRASS PLATES	LOT NO.	030618-6
TYPE OF MATERIAL	C46400-2001 Ed.	DATE	JUL. 18. 2003

DESCRIPTION	CHEMICAL COMPOSITION (%)									Surface	Bending Test
	Copper	Zinc	Lead	Tin	Mn	Si	P	Iron	Ni		
SPEC ' S	59.0~62.0	REM	MAX 0.20	0.5~1.0	-	-	-	MAX 0.10	-	GOOD	No Crack
ACTUAL	61.31	REM	0.011	0.824				0.015			

MATERIAL TEST ITEMS / DETAILS	MECHANICAL TEST			CONDUCTIVITY TEST (%)	DIMENSION(mm)			ELECTRICAL RESISTIVITY (AT 20℃) (OHMS-GRAM/M²)	HARDNESS TEST □ HRB,□ HV	GRAIN SIZE (mm)
	YIELD STR. MPa	TENSILE STR. MPa	ELONGATION (%)		Thickness	Width	Length			
SPEC ' S	MIN 140	MIN 345	MIN 35							
ACTUAL	188	354	39							

NO.	SIZE	Q'TY	REMARK	NO.	SIZE	Q'TY	REMARK
1	42T X 342 X 342	2PCS		7	- B L A N K -		
2	42T X 438 X 438	2PCS		8			
3	- B L A N K -			9			
4				10			
5				11			
6				12			

RECEIVING INSPECTION RECORD
W/O NO.: E50740 RIR NO.: E50740-05
P/O NO.: \ POS NO.: \
RESULT: Accept. REMARK: \
PREPARED BY: APPROVED BY:
Q.C INSP. Q.C SECT. CHIEF
ABS

※ THIS INSPECTION SHEET IS STRICTLY LIMITED TO THE GIVEN SAMPLE & CAN'T USE FOR ADVERTISEMENT, LAWSUIT OR ANY OTHER PURPOSE. 01ED, 02ADD.

WITNESS BY

MANAGER OF QUALITY ASSURANCE SECTION

K.T.I CO., LTD PASSED METAL PRODUCT DIVISION

PAGE NO. 6

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A S M E

REPORT OF MAGNETIC PARTICLE EXAMINATION
자 분 탐 상 검 사 보 고 서

케 이 엔 디 티 앤 아 이 주 식 회 사
Korea Nondestructive Testing & Internet Co., Ltd.
서울特別市 [illegible] 513-14(천성빌딩3층)
電話 : (02) 852-2283 FAX : (02) 861-1298

Report No. 보고서 번호	KNDT-BS-DH-M03-197
Page No. 페이지 번호	1 of 2

Customer(발주처)	EBARA CORPORATION
Project No./Name(공사번호/명)	TUPRAS IZMIR DHP PROJECT
Item No./Name(제품번호/명)	OIL COOLER (CT-9901E1A/E1B)
Part No./Name(부품번호/명)	E50740
TRV No. / Revision / Operation No.	N/A
Procedure No./Code(절차서/코드) / Rev. No.	ASME SECⅧ, DIV.I APP.6
Examination Time(검사시기)	AFTER WELDING
Surface Condition (표면상태)	☐ As Ground ■ As Welded ☐ As Casting ☐ As Machined ☐
Method(자분 적용방법)	■ Continuouse(연속법) ☐ Residual(잔류법)
Magnetization(자화방법)	☐ Prod(프로드) ■ Yoke(요크) ☐
☐ Block Type(시험편종류) 【FIELD INDICATOR】 형 ☐ Field Indicator(자장 지시계)	ILLumination(조도): 1000 Lux / Test Temp.(표면온도): 18 ℃
Current(자화전류) ■AC(교류) L/P BLOCK 10Lb OVER ☐DC(직류) Amp	Demagnetization(탈자) ☐ YES ■ NO

Equipment(탐 상 기)		Magnetic Particle(자 분)	
S/No. (번호)	32066	Maker (제조사)	KYUNG DO. LTD,.
Maker (제조사)	KYUNG DO. LTD.	Density (농도)	g/ℓ 1.2-2.4 ㎖ per 100㎖
Type/Model (종류/모델)	MP-A-3	Type (종류)	☐ Dry(건식) ■ Wet(습식)
Due Date (교정 유효일)	2004. 8. 30	Color (색상)	■ Non-Fluorescent (비 형 광) ☐ Fluorescent (형 광)

Black Light (자외선등)	☐ With (사용) ■ Without (사용 무)	Maker (제조사)	S/No. (번 호)	Intensity (강 도)	Due Date (교정 유효일)
				㎼/㎠	

Indentification No. 확 인 번 호	Accept 합격	Reject 불합격	Interpretation 판 정	Remarks 비 고
CT-9901E1A	V		NO RECORDABLE INDICATION	
CT-9901E1B	V		NO RECORDABLE INDICATION	
========= B L A N K =========				

DONG HWA Q.M부 ☐WITNESSED BY ☐REVIEWED BY

SEE TO ATTCHMENT

Examined by 시 험 자 I. H. LEE Level 레 벨 II

Approved by 승 인 자 C. S. SEO Level 레 벨 III

Date of Examination 검사일자: 2003. 08. 28.

Owner/Customer 주문주/고객 감독관

☐ Third Party Inspector 공인 검사관

☐ ANI/AI (Authorized Nuclear Inspector/Authorized Inspector)

REPORT OF MAGNETIC PARTICLE EXAMINATION

자 분 탐 상 검 사 보 고 서

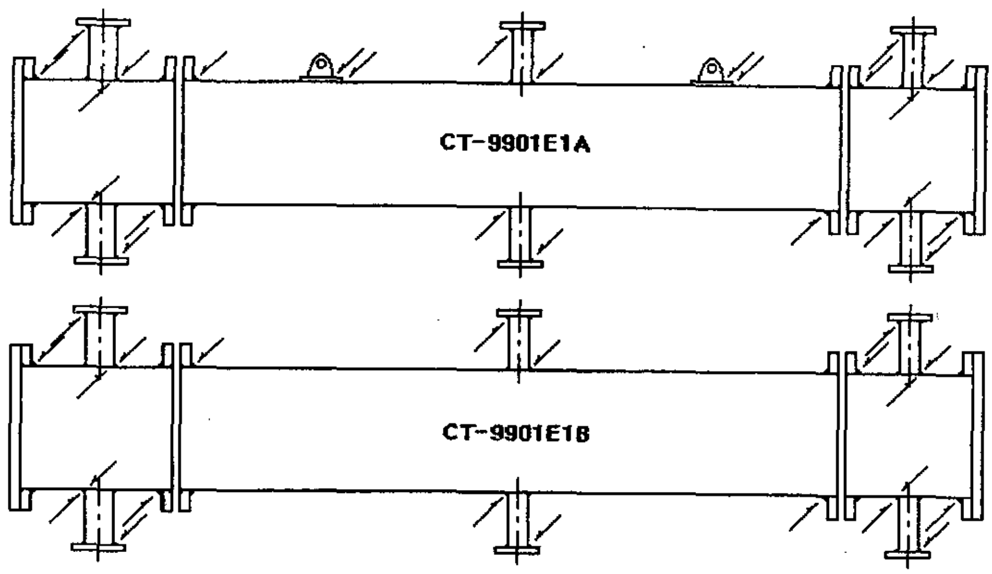
케이엔디티엔아이주식회사
Korea Nondestructive Testing & Internet Co., Ltd.
서울特別市 冠岳區 新林洞 1613-14(금성빌딩3층)
電話 : (02) 852-2223~4 FAX : (02) 861-1298

Report No. 보고서 번호: KNDT-BS-DH-M03-197

Page No. 페이지 번호: 2 of 2

Indentification No. 확 인 번 호	Accept 합격	Reject 불합격	Interpretation 판 정	Remarks 비 고

Sketch



"MT" CHECK POSITION

- ALL NOZZLE WELDING PART
- SHELL,CHANNEL TO FLANGE WELDING PART
- LIFTING LUG WELDING PART
- REMOVE JIG AREA

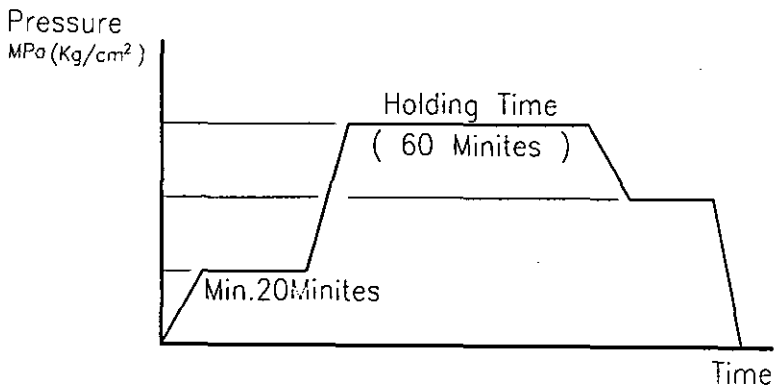
DONG HWA | ☑ WITNESSED BY | ☐ REVIEWED BY | Q.M부

DongHwa Entec — PRESSURE TEST SHEET

PROJECT NAME	TUPRAS IZMIR DHP PJT	CUSTOMER	EBARA CORPORATION
ITEM NAME	OIL COOLER	DHE Job No.	E50740-A
ITEM NO.	CT-9901E1A	DATE	2003. 9 . 3.

DESIGN PRESSURE (Kg/cm²)	SHELL SIDE	TUBE SIDE	PRESSURE GAUGE	
	312.9 PSIG (22.0 Kg/cm²)		I.D. NO.	EXPIRATION DATE

HYDROSTATIC TEST	TYPE	☐ WATER ■ OIL ☐ THE OTHER	☐ WATER ☐ OIL ☐ THE OTHER	097348.	2003. 12. 29.
	TEST PRESSURE	469.4 PSIG (33.0 Kg/cm2)	Kg/cm²		
	TEMPERATURE	24 ℃	℃	097340.	2003. 12. 29.
	HOLDING TIME	60 MIN.	MIN.		
	RESULT	ACCEPT			
PNEUMATIC TEST	TYPE	☐ AIR ☐ HALOGEN ☐ THE OTHER	☐ AIR ☐ HALOGEN ☐ THE OTHER		
	TEST PRESSURE	Kg/cm²	Kg/cm²		
	TEMPERATURE	℃	℃		
	HOLDING TIME	MIN.	MIN.		
	RESULT	-	-		



ABS
ASME AI

PREPARED BY	Y.T.JEONG	WITNESSED BY	
APPROVED BY	H.J.AHN		

A S M E

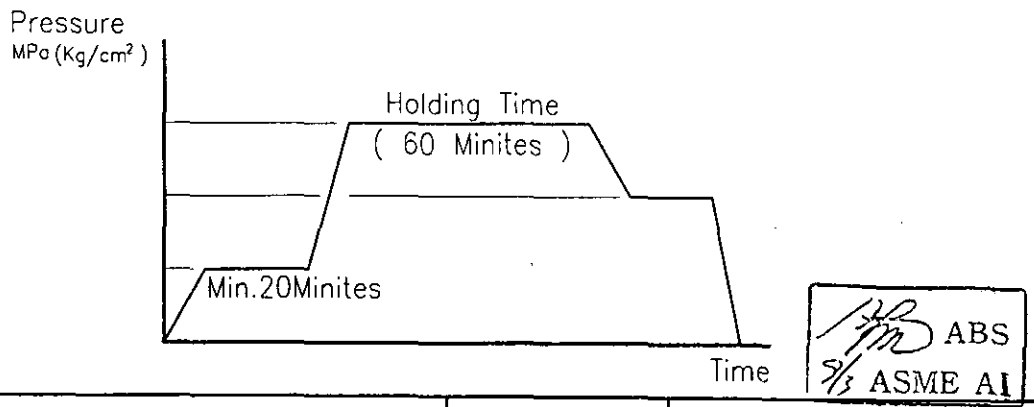
PAGE NO. 23

Page No. / 23

DongHwa Entec — PRESSURE TEST SHEET

PROJECT NAME	TUPRAS IZMIR DHP PJT	CUSTOMER	EBARA CORPORATION
ITEM NAME	OIL COOLER	DHE JoB No.	E50740-B
ITEM NO.	CT-9901E1B	DATE	2003. 9 . 3.

DESIGN PRESSURE (Kg/cm²)		SHELL SIDE	TUBE SIDE	PRESSURE GAUGE I.D. NO.	PRESSURE GAUGE EXPIRATION DATE
		312.9 PSIG (22.0 Kg/cm2)			
HYDROSTATIC TEST	TYPE	☐ WATER ■ OIL ☐ THE OTHER	☐ WATER ☐ OIL ☐ THE OTHER	097346.	2003. 12. 29.
	TEST PRESSURE	469.4 PSIG (33.0 Kg/cm2)	Kg/cm²	097352.	2003. 12. 29.
	TEMPERATURE	24 ℃	℃		
	HOLDING TIME	60 MIN.	MIN.		
	RESULT	ACCEPT			
PNEUMATIC TEST	TYPE	☐ AIR ☐ HALOGEN ☐ THE OTHER	☐ AIR ☐ HALOGEN ☐ THE OTHER		
	TEST PRESSURE	Kg/cm²	Kg/cm²		
	TEMPERATURE	℃	℃		
	HOLDING TIME	MIN.	MIN.		
	RESULT	-	-		



ABS
ASME AI

PREPARED BY	Y.T.JEONG	WITNESSED BY	
APPROVED BY	H.J.AHN		

DHQ-F-97001(Rev.0)

A4(210mmX297mm)

A S M E

PAGE NO. 26

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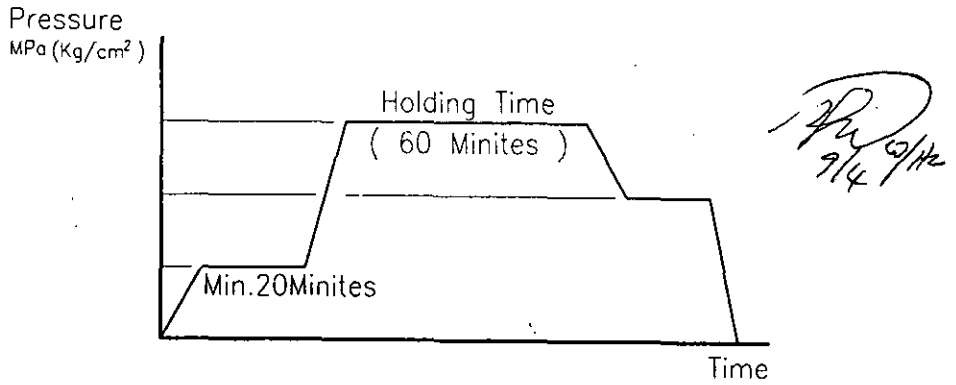
DongHwa Entec

PRESSURE TEST SHEET

PROJECT NAME	TUPRAS IZMIR DHP PJT	CUSTOMER	EBARA CORPORATION
ITEM NAME	OIL COOLER	DHE JoB No.	E50740-A
ITEM NO.	CT-9901E1A	DATE	2003. 9 . 4 .

DESIGN PRESSURE (Kg/cm²)		SHELL SIDE	TUBE SIDE	PRESSURE GAUGE	
			128 PSIG (9.0 Kg/cm²)	I.D. NO.	EXPIRATION DATE
HYDROSTATIC TEST	TYPE	☐ WATER ☐ OIL ☐ THE OTHER	■ WATER ☐ OIL ☐ THE OTHER	116547.	2004. 5. 9.
	TEST PRESSURE	Kg/cm²	192.0 PSIG (13.5 Kg/cm2)	116513.	2004. 5. 9.
	TEMPERATURE	℃	24 ℃		
	HOLDING TIME	MIN.	60 MIN.		
	RESULT	-	ACCEPT		
PNEUMATIC TEST	TYPE	☐ AIR ☐ HALOGEN ☐ THE OTHER	☐ AIR ☐ HALOGEN ☐ THE OTHER		
	TEST PRESSURE	Kg/cm²	Kg/cm²		
	TEMPERATURE	℃	℃		
	HOLDING TIME	MIN.	MIN.		
	RESULT	-	-		



9/4 9/Hr

PREPARED BY	Y.J.JEONG	WITNESSED BY	
APPROVED BY	H.S.AHN		

DHQ-F-97001(Rev.0)

A4(210mmX297mm)

A S M E

PAGE NO. 21

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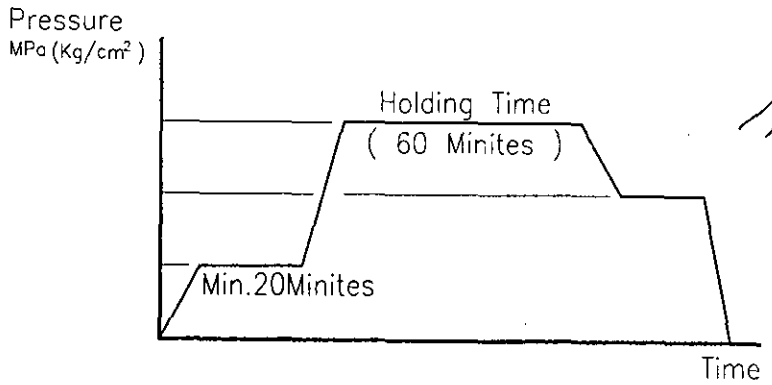
DongHwa Entec — PRESSURE TEST SHEET

PROJECT NAME	TUPRAS IZMIR DHP PJT	CUSTOMER	EBARA CORPORATION
ITEM NAME	OIL COOLER	DHE Job No.	E50740-B
ITEM NO.	CT-9901E1B	DATE	2003. 9. 4.

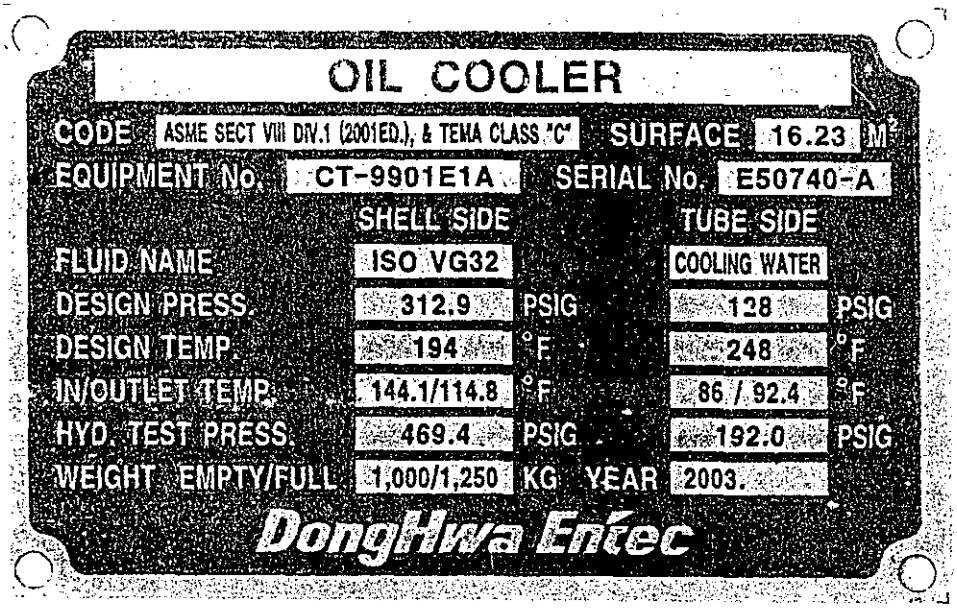
DESIGN PRESSURE (Kg/cm^2)		SHELL SIDE	TUBE SIDE	PRESSURE GAUGE	
			128 PSIG (9.0Kg/cm^2)	I.D. NO.	EXPIRATION DATE
HYDROSTATIC TEST	TYPE	☐ WATER ☐ OIL ☐ THE OTHER	■ WATER ☐ OIL ☐ THE OTHER	134437	2003. 12. 29.
	TEST PRESSURE	Kg/cm^2	192.0 PSIG (13.5 Kg/cm2)		
	TEMPERATURE	℃	24 ℃	134455	2003. 12. 29.
	HOLDING TIME	MIN.	60 MIN.		
	RESULT	-	ACCEPT		
PNEUMATIC TEST	TYPE	☐ AIR ☐ HALOGEN ☐ THE OTHER	☐ AIR ☐ HALOGEN ☐ THE OTHER		
	TEST PRESSURE	Kg/cm^2	Kg/cm^2		
	TEMPERATURE	℃	℃		
	HOLDING TIME	MIN.	MIN.		
	RESULT	-	-		



PREPARED BY	Y.T.JEONG	WITNESSED BY	
APPROVED BY	H.W.AHN		

DHQ-F-97001(Rev.0)

A4(210mmX297mm)



OIL COOLER

CODE ASME SECT VIII DIV.1 (2001ED.), & TEMA CLASS "C" SURFACE 16.23 M²

EQUIPMENT No. CT-9901E1A SERIAL No. E50740-A

	SHELL SIDE		TUBE SIDE	
FLUID NAME	ISO VG32		COOLING WATER	
DESIGN PRESS.	312.9	PSIG	128	PSIG
DESIGN TEMP.	194	°F	248	°F
IN/OUTLET TEMP.	144.1/114.8	°F	86 / 92.4	°F
HYD. TEST PRESS.	469.4	PSIG	192.0	PSIG
WEIGHT EMPTY/FULL	1,000/1,250	KG	YEAR 2003.	

DongHwa Entec

DONG HWA ☐ WITNESSED BY ☑ REVIEWED BY Q.M보

OIL COOLER

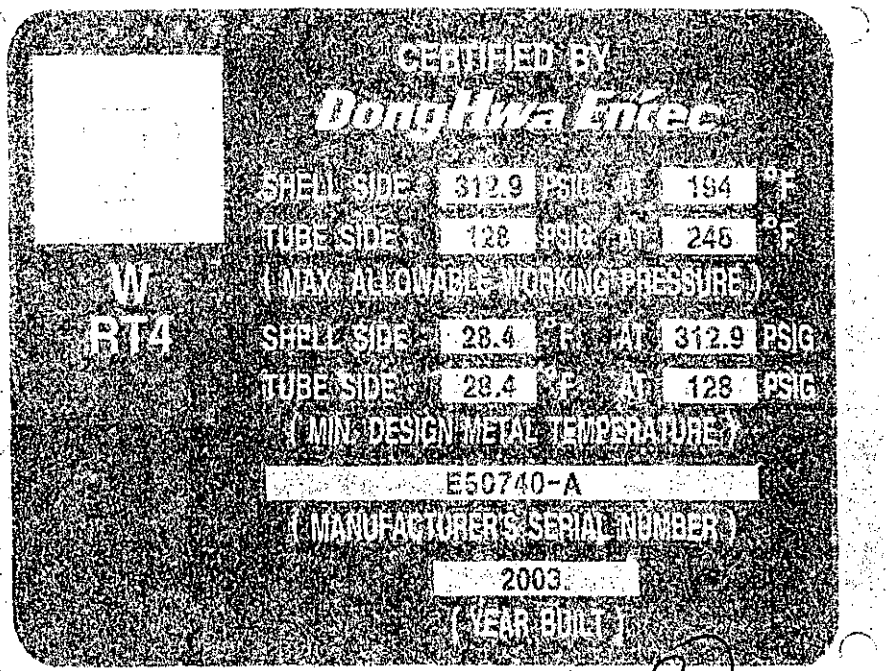
CODE	ASME SECT VIII DIV.1 (2001ED.), & TEMA CLASS "C"		SURFACE	16.23	M²
EQUIPMENT NO.	CT-9901E1B		SERIAL No.	E50740-B	
	SHELL SIDE			TUBE SIDE	
FLUID NAME	ISO VG32			COOLING WATER	
DESIGN PRESS.	312.9	PSIG		128	PSIG
DESIGN TEMP.	194	°F		248	°F
IN/OUTLET TEMP.	144.1/114.8	°F		86 / 92.4	°F
HYD. TEST PRESS.	469.4	PSIG		192.0	PSIG
WEIGHT EMPTY/FULL	1,000/1,250	KG	YEAR	2003.	

DongHwa Entec

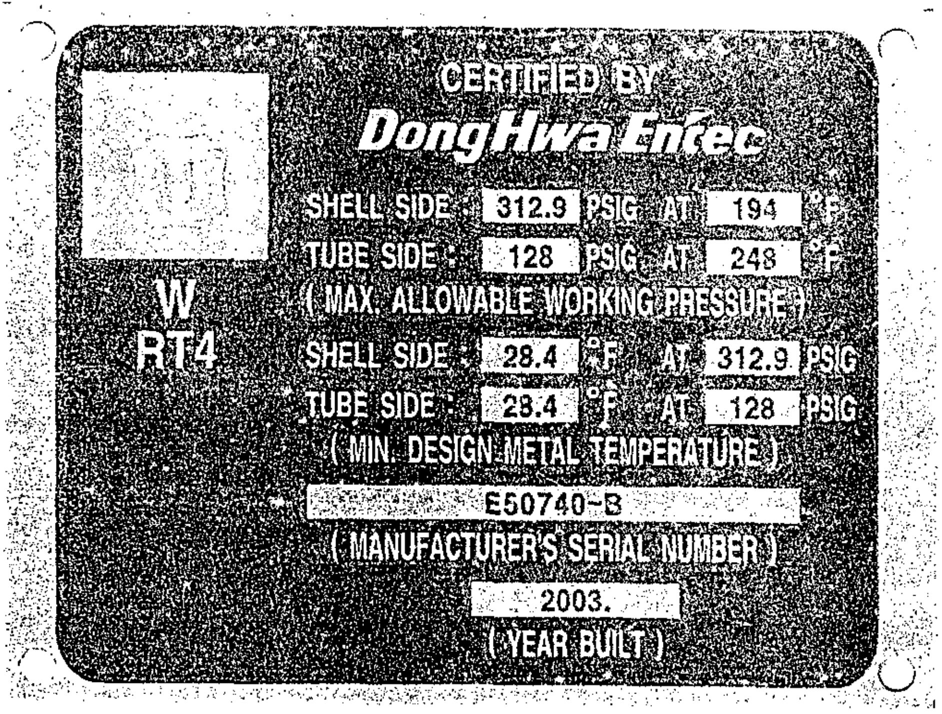
DONG HWA	☐ WITNESSED BY ☑ REVIEWED BY
Q.M	

A S M E

PAGE NO 34
28



DONG HWA	☐ WITNESSED BY ☑ REVIEWED BY
Q.M부	



DONG HWA	☐ WITNESSED BY ☑ REVIEWED BY
Q.M부	

MISUZU

INSPECTION REPORT

CUSTOMER : ELLIOTT EBARA TURBO MACHINERY CORPORATION	EBARA SER. NO. : R021570804
ARTICLE : LUBE OIL CONSOLE UNIT	ITEM NO. : CT-9901/TC-9901
ITEM : FILTER	SERIAL NO. : U-2549
DRAWING NO. : ER021570804／902 (K1-01692)	INSPECTION DATE : 30th OCT. 2003

CUSTOMER : LG ENGINEERING & CONSTRUCTION CORP.

FINAL USER : TURKISH PETROLEUM REFINERIES CORP.

PROJECT : TUPRAS IZMIR REFINERY DHP PROJECT

JOB. NO. : 7020

SERVICE : RECYCLE GAS COMPRESSOR

ITEM NO. CT-9901F1A/F1B

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed

EETC Q.C Dept.

Certified by :

Inspected by : H. Tanaka

MISUZU Industrial Corporation

FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS
(Alternative Form for Single Chamber, Completely Shop-Fabricated Vessels Only)
As Required by the Provisions of the ASME Code Rules, Section VIII, Division 1

31

1. Manufactured and certified by: INDUFIL BV, Nieuwgraaf 79, 6921 RK Duiven, The Netherlands (Name and address of manufacturer)

2. Manufactured for: Tokyo Sangyo Co. Ltd., Osaka Branch, Room No. 701 Hanshin Sankei, Sakurabashi Bldg., No. 4-13 Umeda 2-Chome Kita-Ku, Osaka 530-0001, Japan (Name and address of purchaser)

3. Location of installation: Unknown (Name and Address)

4. Type: Vert. (Horiz. or vert. tank) | 2003.1536.1(A/B) (Mfgr's serial No.) | - (CRN) | 057.63.096.02.REV.A (Drawing No.) | 2007-2008 (Nat'l. Bd. No.) | 2003 (Year Built)

5. The chemical and physical properties of all parts meet the requirements of material specifications of the ASME BOILER AND PRESSURE VESSEL CODE.

The design, construction, and workmanship conform to the ASME Rules, Section VIII, Division 1 2001 (year)

to 2002 (Addenda (date)) | 2155/2156 (Code Case Nos.) | - (Special Service per UG-120(d))

6. Shell: SA-105 (Matl. (Spec. No., Grade)) | 0.59" (Nom. Thk (in.)) | 0.12" (Corr. Allow. (in.)) | 4.45" (Diam. I.D. (ft. & in.)) | 29.92" (Length (overall) (ft. & in.))

7. Seams:

Long. (Welded, Dbl., Sngl., Lap, Butt)	R.T. (Spot or Full)	Eff. (%)	H.T. Temp. (°F)	Time (hr)	Girth (welded, Dbl., Sngl., Lap, Butt)	R.T. (Spot, Partial, or Full)	No. Of Courses
Sml	None	100	-	-	-	-	1

8. Heads: (a) Matl. SA-105 (Spec. No. Grade) (b) Matl: SA-105 (Spec. No. Grade)

	Location (Top, Bottom, Ends)	Minimum Thickness	Corrosion Allowance	Crown Radius	Knuckle Radius	Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure (Convex or Concave)
(a)	Top	1.34"	0.12"	-	-	-	-	-	6.30"	-
(b)	Bottom	0.79'	0.12"	-	-	-	-	-	6.30"	-

If removable, bolts used (describe other fastenings) SA 193 B7, SA-194 2H, 8 pcs., ½"- 13 UNC for top head only (Matl., spec., Gr., Size, No.)

9. MAWP 313 psi at max. temp 212 °F

Min. Design metal temp. -20 °F at 313 psi. Hydro, ~~pneum, or comb.~~ Test pressure 470 psi

10. Nozzles, inspection and safety valve openings:

Purpose (Inlet, Outlet, Drain)	No	Diam. or Size	Type	Matl	Nom. Thk	Reinforcement Matl.	How Attached	Location
inlet/outlet	2	2"SAE	Bolted	-	-	-	-	-
drain/vent	3	1"SAE	Bolted	-	-	-	-	-
[illegible]n	2	¾"NPT	Threaded	-	-	-	-	-
e[illegible]l conn.	1	1"SAE	Bolted	-	-	-	-	-

11. Supports: Skirt - (yes or no) Lugs - (No.) Legs - (No.) Other Lifting lug (Describe) Attached Lugs threaded on cover (Where and how)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report: none (Name of part, item number, Mfgr's name and identifying stamp)

UG-125 is user's responsibility
Impact testing is exempted by UCS66 (b) for all components
All nozzles are machined openings with no permanent attached nozzle necks
Removable top-head identified with manufacturer's serial no. and mark

CERTIFICATE OF SHOP COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME Code for Pressure Vessels, Section VIII, Division 1. "U" Certificate of Authorization No. 31.295 expires 27 aug. 2005

Date June 17th 2003 Co. name INDUFIL BV THE NETHERLANDS (Manufacturer) Signed [signature] (Representative)

CERTIFICATE OF SHOP INSPECTION

Vessel constructed by INDUFIL BV THE NETHERLANDS at Nieuwgraaf 79, 6921 RK Duiven, The Netherlands

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State of Province of Pennsylvania and employed by LR Insurance Inc., of Delaware have inspected the component described in this Manufacturer's Data Report on June 17th 2003, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME Code, Section VIII, Division 1. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date June 17 2003 Signed [signature] (Authorized inspector) Commissions NB12462A – Pennsylvania 2917 (Nat'l Board (incl. endorsements) State, Prov. and No.)

INDUFIL®

Indufil BV, Nieuwgraaf 79, 6921 RK Duiven, The Netherlands, P.O. Box 442, 6900 AK Zevenaar, The Netherlands.
VAT.No.: NL-802897782 B01, Telephone: +31 26 3190800, Telefax: +31 26 3190808. E-mail: indufil@indufil.com.

III. CERTIFICATE OF COMPLIANCE
KONFORMITÄTSBESCHEINIGUNG
CERTIFICAT DE CONFORMITÉ

Customer	Kunde	Client	**TOKYO SANGYO CO. LTD. OSAKA BRANCH**
Purchase ordernr.	Bestell-Nr	No de com. Client	**822-35561 ITEM 1**
Purchase tag nr.	Tag-Nr	No de repère	**CT-9901F1(A/B)**
Indufil ordernr.	Indufil Auftr.-Nr.	No de fabr. Indufil	**2003.1536.1(A/B)**
Subject	Gegenstand	Objet	**IDGL 2-620 - 2"ANSI-300lbs.RF**
Third party reg. nr.	Vorprüfungsnr.	No de reg. de cert. aut	**2007-2008**
Year of manufacture	Herstellungsjahr	Année de construct.	**2003**
Drawing number	Zeichnungsnummer	No de plan	**057.63.096.02.REV.0**

Pressure vessels have been designed and constructed according to ASME VIII DIV.1 ED'2001 ADD'2002 and customer requirements.
The dimensions of the pressure vessels have been checked in accordance with the drawing, nr 057.63.096.02.REV.0.The sectional drawing as mentioned above is integrated in the general arrangement drawing 057.63.096.99.REV.C and therefor not included in this datareport.

Die Druckbehälter sind nach ASME VIII DIV.1 ED'2001 ADD'2002 entworfen und hergestellt entsprechend der Kundenspezifikation.
Die Abmessungen der Druckbehälter wurden gemäß Zeichnungs-Nr. 057.63.096.02.REV.0 kontrolliert.
Die obengenannte Schnittzeichnung ist in das Maßbild 057.63.096.99.REV.C integriert und deshalb nicht beim Behälterpass eingeschlossen.

Les récipients de pression conçus et fabriqués selon les exigences du ASME VIII DIV.1 ED'2001 ADD'2002 et celles du client.
Les dimensions des récipients de pression sont vérifiées par rapport au plan No 057.63.096.02.REV.0.
Le plan coupe mentionée ci-dessu est intégrée dans le plan général 057.63.096.99.REV.C et nést pas incluse dans ces données rapportées.

Third party / Abnahmeges. / Cert. Aut.	Customer / Kunde / Client	QA Dept. / QA Abt. / Service QA
LR INSURANCE INC.	TOKYO SANGYO CO. LTD. OSAKA BRANCH	INDUFIL B.V. Quality assurance T.P.E. Giezen 1 JUL 2003 This is a true copy of the original certificate. Date: 03-07-2003

MATERIAL INDEX – WERKSTOFF INHALT – INDEX DU MATERIEL	Purchase order no : 822-35561 ITEM 1 Bestell-Nr : No de commande :	Tag no : CT-9901F1(A/B) Tag-Nr : No de repere :
Indufil Ordernr: 2003.1536.1(A/B) Indufil Auftr.-Nr. / No de fabr. Indufil:	Drawing Nr: 057.63.096.99.REV.C Zeichnungs Nr / No de plan:	Subject : IDGL 2-620 - 2"ANSI-300lbs.RF Gegenstand / Objet:
Herewith we declare that for the manufacturing of the undermentioned materials, the material type are proven by works certificates	Wir bescheinigen hiermit, dass die Herstellung nachstehenden Werkstoffe verwendet und durch Werkstoffzertifikaten belegt sind.	Nous déclarons que pour la fabrication des matériaux mentionnés ci-dessus, les types de matériaux sont garantis par les certificats.

Partnr. Teilnr. Piece No	Name of part Bauteil Designation	Material type Werkstoff Type de matériaux	Manufacturer Hersteller Fabrikant	Kind of certificate Art des Zertifikat Norm de certificat	Charge number Schmelzennummer No de coulée	Page nr. Seite Nr. Page No.
01	FILTERBODY	SA-105	NMH	EN 10204 – 3.1B	46789	10-12
04	COVER	SA-105	NMH	EN 10204 – 3.1B	46789	10-12
13	BALL VALVE	SEE MATERIAL INDEX BALL VALVE POS. 04				40
23	VALVE CONNECTION	S355J2G3N	HUTA	EN 10204 – 3.1B	123476	13-14
23	VALVE CONNECTION	S355J2G3	INEXA	EN 10204 – 3.1B	J2152	15-17
25	FLANGE	SA-105	KUZNIA JAWOR SA	EN 10204 – 3.1B	122008	19
26	PLUG	SA-105	DELCORTE	EN 10204 – 3.1B	C39	20
29	SPECTACLE BLIND	1.4404 DIN 17440	ALZ	EN 10204 – 3.1B	E907002	21-22
42	PLUG	SA-105	OMC	EN 10204 – 3.1B	D10	23
43	FLANGE CONNECTION	SA-105	NMH	EN 10204 – 3.1B	55808	24-27
43	FLANGE CONNECTION	SA-105	HUTA	EN 10204 – 3.1B	103990	28-31
43	FLANGE CONNECTION	C22.8N DIN 17243	HUTA	EN 10204 – 3.1B	122077	32-34

Signed: T.P.E. Giezen

Date: 03-07-2003

INDUFIL B.V.
Quality Assurance
Date
Signed: T.P.E. Giezen

INDUFIL B.V. This is a true copy of the original certificate

MACHINEFABRIEK HEERBAART B.V.

FLENZEN EN FITTINGEN

Sloetsweg 228 - 7556 HV Hengelo
Postbus 283 - 7550 AG Hengelo
Telefoon: 074 - 242 75 75
Telefax: 074 - 242 76 46
E-mail: heerbaart@castel.nl
Handelsregister Enschede
nr. 06014551

INDUFIL BV
POSTBUS 442
6900 AK ZEVENAAR

T.a.v. Afd. Attesten

Fabriekscertificaat
Workscertificate

EN 10204 - 3.1.B

NR.

Fabrieksstempel:
Mark of factory:

Persoonlijk stempel:
Personal mark:

Uw order nr.: 1491/01
Your ref.:

Ons order nr.: 21036
Our ref.:

Overstempeling is uitgevoerd overeenkomstig de originele merken.

Restamping has been carried out in accordance with the original marks.

Item Pos. nr.	Aantal Quantity	Artikel Article	Materiaal Material	Charge Heat nr.	Proef Test nr.
1	10	FILTERBODY IDGH 2-620 2"3000 TEK. 045 63 100 01	C22.8/A105N	46789	
1A	10	COVERS	C22.8/A105N	46789	

Item Pos. nr.	Zie aangehecht certificaat leverancier basismateriaal. See attached certificate of basematerial supplier.	
1	V 7017	ø 165
1A	V 7017	ø 165

Visuele controle en afmetingen akkoord bevonden.
Visual inspection and dimensions satisfactory.

Handtekening:
Signed:

Hengelo 22-08-01

This is a true copy of the original certificate.

QC: INDUFIL B.V.

NMH Stahlwerke GmbH i.K.

Abnahmeprüfzeugnis
Inspections certificate

(DIN EN 10204 -3.1B)

NMH Stahlwerke GmbH, Postfach 1344, 92231 Sulzbach-Rosenberg

ESRO Staal Services BV
Weena 723 (C5)
NL-3001 GD ROTTERDAM

Ihre Bestellung-Nr. / vom / *Your order No./of*	V 7017 10.04.2001
	01792
Unsere Auftrags-Nr. / *Our order No./item*	89873 - 3
Freigabetag / *date of release*	
Werkstoffbezeichnung / *Material designation*	C22.8N/A105/SA105
Abmessung / *dimension*	165 mm rd./round
Freigabemenge / *weight*	21380
Stückzahl / *quantity*	12
Erschmelzungsprozeß / *melting process*	Sauerstoffblasverfahren / Y
Erzeugnisform / *type of product*	Strangguss gewalzt / rolled from co-materials
Lieferzustand / *heat treatment*	normalisiert/normalized
Schmelze / *heat No.*	46789
Umformgrad / *degree of deformation*	6.44
Zeichen des Herstellwerkes / *manufacturer's symbol*	NMH
Zeichen des Werkssachverständigen / *inspector's symbol*	NMH R

Lieferung erfolgte nach technischer Vorschrift / *according to technical regulations No.:* DIN17243,ASTM A105,ASME SA105,LV ESRO 0460.00

AD-W0,AD-W13,TRD100,TRD107,LRS Rules Part2 Chapt5 Sec3 2000

Sonstige Vermerke / *other remarks:* Wärmebeh. 2 Std. 950°C Zert.Nr.73 Zugpr.durchm. 14mm

Chemische Zusammensetzung in % *Chemical composition in %*

C	Si	Mn	P	S	Al	Cr	Ni	Mo	V	Cu	As
0.21	0.26	0.87	0.013	0.003	0.026	0.22	0.07	0.01	0.01	0.07	0.006

Sn	N	B	Ti	Nb	Ca	O	H			CE-Wert	Di-Wert
0.004				0.002						.412	

Mechanische Eigenschaften *Mechanical properties*

Behandlungszustand der Proben / *conditions of treatment:* normalisiert/normalized unbehandelt

Probennr. / *sample No.*	Probenlage / *sample direction*	°C	ReH N/mm²	Rm N/mm²	A in %	Z in %	Kerbschlagarbeit / *impact value* Probennr.	Probenlage	Probenform / *type of test piece*	°C	J	J	J	ø J	J/qcm
648k	q	20	300	501	27.4	61.4	648k	q	ISO-V	20	131	151	144	142	
648f	q	20	314	494	24.7	63.1	648f	q	ISO-V	20	150	133	130	138	
9k	q	20	307	496	25.1	63.1	649k	q	ISO-V	20	155	130	135	140	
	q	20	322	510	26.0	62.3	649f	q	ISO-V	20	138	138	131	136	

Härte / hardness

Anlieferungsfestigkeit: 152 HB
supplying hardness

Normalisierungsfestigkeit: *normalized hardness*

Austenitkorngröße: *austenit core size*

Mikroreinheitsgrad K4 - Methode: *micro degree of purity* Sulfid Oxid Gesamt / *total*

US-Prüfung / *ultrasonic test*
nach SEP 1921 PG 3 C/c
ohne Mängel

Verwechslungsprüfung / *mixing up test*
100% geprüft
ohne Mängel

Riß-Prüfung / *flaw detection*

Stirnabschreckversuch / *Jominy test*

Härtetemp. mm / *curvy temp.*															

Die mech.-technol. Erprobung erfolgte an beiden Enden der Walzlänge von 32 m.
Besichtigung und Masskontrolle ohne Mängel.
Anforderungen: Re >=250 N/qmm, Re +450°C >=70N/qmm, Rm 485-540 N/qmm, A >=22%, K ISO-V >=31J
Lieferlängen: 8x12.00, 3x7.80, 1x8.00 m

LR AUG 01

Seite 1/2

Werksachverständiger Renner

Data verified and accepted
Indufil QA-Department

This is a true copy of the original certificate.
QC
INDUFIL B.V.

Stahlwerke GmbH i.K.

Abnahmeprüfzeugnis
Inspections certificate
(DIN EN 10204 - 3.1B)

NMH Stahlwerke GmbH, Postfach 1344, 92231 Sulzbach-Rosenberg

ESRO Staal Services BV
Weena 723 (C5)
NL-3001 GD ROTTERDAM

Ihre Bestellung-Nr. / vom / *Your order No./of*	V 7017
Unsere Auftrags-Nr. / *Our order No./item*	89873 - 3
Freigabetag / *date of release*	
Werkstoffbezeichnung / *Material designation*	C22.8N/A105/SA105
Abmessung / *dimension*	165 rd./round
Freigabemenge / *weight*	21380 12
Erschmelzungsverfahren / *melting process*	Sauerstoffblasverfahren / Y
Erzeugnisform / *type of product*	Strangguss gewalzt / rolled from cc-materials
Lieferzustand / *heat treatment*	normalisiert/normalized
Schmelze / *heat No.*	46789
Umformgrad / *degree of deformation*	6.44
Zeichen des Herstellwerkes / *manufacturer's symbol*	NMH
Zeichen des Werkssachverständigen / *inspector's symbol*	NMH R

Fortsetzung der mechanischen Eigenschaften *Mechanical Properties continued*

Probennr. / *Sample No.*	Probenlage / *direction*	°C	ReH N/mm²	Rm N/mm²	A in %	Z in %	Kerbschlagarbeit / Impact value: Probennr.	Lage	Probenform	°C	J	J	J	Φ J	J/qcm
650 k	9	20	308	497	25.0	62.3	650 k	9	ISO-V	20	134	114	110	119	
650 f	9	20	309	490	23.9	65.7	650 f	9	ISO-V	20	131	118	138	132	
651 k	9	20	350	496	23.4	64.0	651 k	9	ISO-V	20	126	135	150	137	
651 f	9	20	320	499	25.7	66.5	651 f	9	ISO-V	20	140	145	142	142	
	9	450	158												

LR AUG 8

Dieses Zeugnis wurde maschinell erstellt.
This certificate was machine made.
07.08.2001, NMH Stahlwerke, Qualitätsstelle

Seite 2/2

Data viewed
and accepted
Indufil QA-Department

This is a true copy of the original certificate.
QC: INDUFIL B.V.

Bromefa b.v. machinefabriek

Ohmstraat 9 - 11, 6716 BA Ede
Postbus 402, 6710 BK Ede
Tel.: 0318 - 631938
Fax: 0318 - 634233
Rabobank, rek.nr. 37.70.00.892
Postbank: 437.53.23
K.v.K. nr. 09075061
E-mail: info@bromefa.nl

REMARKING DECLARATION.

Client: Indufil **Orderno.: 1965/01**

We herewith declare, that the delivered products "In/Outlet"

Material:	**S355J2G3**
Dimensions:	**Ø 120**
Certified to:	**EN 10204/3.1.B**
Number certificate:	**15873/2002**
Name of manufacturer:	**Huta L.W.**

All pieces have been marked with the castnumber and the "bromefa-stamp".
Castnumber: 123476

J BRO

The undersigned has performed the remarking in accordance with Sheet G 0304 form "rules Pressure vessels" issued by the Dutch Government Authority " Dienst voor het Stoomwezen".

The remarking has been verified by R. Jongkees, employee of *Bromefa* QA.

Respectfully:
Bromefa B.V.

This is a true copy of the original certificate

QC: INDUFIL B.V.

HUTA L.W.

Spółka z o.o.

ul.Kasprowicza 132, 01-949 WARSZAWA
fax: 48/22 8364222, 48/22 8340952 tlx: 82-83-61

Contract dated 2001-11-19
PL/010592085/01-1753

ŚWIADECTWO ODBIORU
INSPECTION CERTIFICATE
ABNAHMEPRÜFZEUGNIS
ACCORDING TO EN 10204
3.1.B

Certificate No. 15873/2002(111) Date 2002-03-27

Confirmation No. 783303/2001 **3/**3

Department: W-45

Order No/Bestell-Nr
1000239870

Consignee/Empfänger

ODS BV

BARENDRECHT
NETHERLANDS-NIDERLANDY

ODS-NR. 115614 (020014009)

Order No/Bestell-Nr
1.4465020
dated/Datum
2001-10-31

Purchaser/Käufer (000000939)

We hereby certify that the quality of the goods is conforming
with standards and other documents marked in this Inspection Certificate.
Wir bestätigen hiermit, daß die gelieferten Erzeugnisse
den Bedingungen der Normen sowie der anderen hier genannten Vorschriften entsprechen.

Article
Gegenstand (GPO)
Hot Rolled Round Bars
Rundstange warmgewalzt

Delivery conditions
Lieferzustand (N)
Normalized
Normalisiert

Material destination
Materialverwendung (PMm)
for mechanical working
zur mechanische Bearbeit.

Material
Werkstoff S355J2G3

standard
normen EN 10025

Heat No
Schmelze-Nr 123476

Dimensions Diameter
Abmessungen[mm] Durchmes. 120

Manufacturing length from: 4.500 to: 6.000 [m]
Fabrikatlänge von: bis:

Weight[kg] 5.350
Gewicht[kg]

Bars 12
Stäbe

Standards
Normen DIN 1013 EN 10025

Ladle chemical analysis [%]
Schmelze chemische Zusammensetzung [%]

C	Mn	Si	P	S	Cr	Ni	Cu	Mo	Al	27
0,17	1,11	0,26	0,010	0,003	0,10	0,12	0,27	0,03	0,023	0,41

27=Ce=C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15;

-Mechanical properties/Impact test according to
-mechanische Eigenschaften/Kerbschlagzähigkeit entsprechend EN 10002-1 / EN 10045

Direction Richtung	Re [N/mm2]	Rm [N/mm2]	A5 [%]	Z[%]	ISO-V [J]	Impact test temperature Kerbschlagzähigkeitprüftemperatur
L	350	525	27,0	70,5	156,0-151,0-148,0	-20,0°C

-Surface defect examination Class according to
-Oberflächenfehlerprüfung Klasse 1 entsprechend SEL 055E

-Ultrasonic examination Class Group (Positive) according to
-Ultraschallprüfung Klasse B Gruppe 3 (Positiv) entsprechend SEP 1920

N-900°C-Luft/air
HB 143-146
38/LRS KAT 0200283

Spark test 100% Funkenprobe 100%
ADW 0
ADW 13
TRD 100
TRD 107
TRB 100

Data verified
and accepted
Indufil QA-Department

Responsible: Quality Management Department
Verantwortlicher: Qualitätssicherungabteilung
2002-04-03 14:03:01

Manager M.Sc.Eng.
Leiter Dipl.Ing. Beata Staniszewska

GRUPPOLUCCHINI

1/1

This is a true copy of the original certificate.

QC: INDUFIL B.V.

Bromefa b.v. machinefabriek

Ohmstraat 9 - 11, 6716 BA Ede
Postbus 402, 6710 BK Ede
Tel.: 0318 - 631938
Fax: 0318 - 634233
Rabobank, rek.nr. 37.70.00.892
Postbank: 437.53.23
K.v.K. nr. 09075061
E-mail: info@bromefa.nl

REMARKING DECLARATION.

Client: Indufil **Orderno.: 1452/02**

We herewith declare, that the delivered products "In/Outlet"

Material:	**S355J2G3**
Dimensions:	**∅ 120**
Certified to:	**EN 10204/3.1.B**
Number certificate:	**165682/3**
Name of manufacturer:	**Inexa Profil**

All pieces have been marked with the *castnumber* and the "*bromefa-stamp*".
Castnumber: J2152

J
BRO

The undersigned has performed the remarking in accordance with Sheet G 0304 form "rules Pressure vessels" issued by the Dutch Government Authority " Dienst voor het Stoomwezen".

The remarking has been verified by R. Jongkees, employee of Bromefa QA.

Respectfully:
Bromefa B.V.

This is a true copy of the original certificate.

INDUFIL B.V.

CERTIFICATE

Product	ODS-NR.	Purchaser
ROUNDS Delivery conditions AS-ROLLED Steel grade S355J2G3(XM) Specification EN 10025 FEB. 1994	090334	ODS B.V. POSTBUS 69 NL-2990 AB BARENDRECHT NEDERLÄNDERNA

Internal spec.	Certificate No	Our order No	Page
LF04.070/2	165682/3	132023	1(2)

Purchaser's order No: 1000215695

Intended for:

DIN EN 10204-3.1B

Extent of delivery:

Item	Dimension mm	Length mm	Pieces	Wgt. kg	Heat no
9	120	6660	18	10720	J2152
11	150	6470	6	5430	J2152
		Tot:	24	16150	

Chemical composition %:

Heat no	C	Si	Mn	P	S	Cr	Ni	Cu	V	Al
J2152	0,13	0,33	1,21	0,008	0,029	0,194	0,033	0,002	0,061	0,016

Mo	N	EC	Al+V>=20
0,003	0,012	39	0,077

Test results:

-Mechanical properties-

Heat no	REH Mpa	Rm Mpa	A5 %	Z %	KV(J) V1	V2	V3	mv	Temp C	Hardn. HB	Machinab. V15 (m/min)
J2152	389	549	25	61	100	94	86	93	20-	179	496
J2152	394	556	22	54	35	39	33	36	20-	179	496
Cond:		CR				CR				U	U

Ultrasonic testing has been carried out according to SEP1921/3, E/e. The material has been found suitable for it's purpose.

Data verified and accepted

Indufil QA-Department

QC: INDUFIL B.V.

CERTIFICATE

Certificate No	Our order No	Page
165682/3	132023	2(2)

We hereby certify that the goods described above comply with the purchase agreement and that the goods have been tested in accordance with the directions in purchase agreement with the results stated above.

Luleå 2001-08-17
INEXA PROFIL AB

Authorized representative

INEXA PROFIL
MARGARETA EKLANDER
AUTHORIZED INSPECTOR

Data verified
and accepted
Indufil QA-Depart

FIL B.V.

KUŹNIA JAWOR SA

ISO 9002 DEKRA CERTIFICATION SERVICES

59-400 Jawor, ul Kuziennicza 4
POLAND

Zertifikat-Registrier- Nr G 30900753

Überprüft als Hersteller nach AD-Merkblatt WO/TRD 100

Abnahmeprüfzeugnis / Test report / Certificat de réception 218/TJ/02
EN 10204 – 3 1 B / DIN 50049-3.1 B

Besteller / Customer / Client: P van LEEUWEN Jr s BUIZENHANDEL BV	Zeichen des Herstellerwerkes / Manufacturer's brand / Marque du producteur: K
Erzeugnis / Product / Produit: ASME SLIPON FLANGES RF 2 " 300 LBS	Bestell-Nr. / Order-No. / No De contrat: 3213483 poz 32
Werkstoff / Material / Materiau: C21/A105N TUEV W399/3 ASTM A105M-98 SA105 ASME PART A SEC II 2001 FORGED NACE MR 0175-00 FORG 1250-1150°C NORM 870-900 °C still air	Stuckzahl / Number / Nombre: 168 — Stempel des Abnehmers / Stamp of testing engineer / Etampe du contrôleur: A
Anforderungen / Demands: AD-W9(7/98), TRD107 (12/96); TRB100 ASME B 16,5-a 98	Schmelze Nr./Nr des / Heat No /Test No. / No de Coulée/No. d'essai: 122008 VLB 2

CHEMISCHE ZUSAMMENSETZUNG–CHEMICAL COMPOSITION–COMPOSITION CHEMIQUE

% C	% Mn	% Si	% P	% S	% Cr	% Al	% Mo	% Ni	% Cu	% N	% Nb	% V	% Ti
0,21	0,93	0,23	0,004	0,004	0,04	0,020	0,01	0,07	0,20		0,001	0,00	

CEV = 0,39 *mit/with/avec* CEV = C + Mn /6 + (V +Mo + Cr) /5 + (Ni + Cu) /15

Erschmelzungsart / Melting Process / Mode de Fusion E

Prufergebnisse / Test results / Resultats d'essais

Probe/sample/essai Nr / No / No	Lage / Orientation / Position	Temper Temp Temp.	ReH / Rp 0,2%	ReH / Rp 1,0%	Rm	A $L_o=4d_o$ $L_o=2"$	Z	EN 10045-1 Av /K 10x10mm	Temper Temp Temp.	Form Forme Form	Härte Hardness Dureté (Brinell)
		[°C]	[N/mm²]	[N/mm²]	[N/mm²]	[%]	[%]	[J]	[°C]		
Min Max	TANG	20	250		485 630	22	30	31/22(Singl)	20	V	137 187
2702	Q	20	359		499	33,5	70,0	188/184/182	20	V	148
			357		504	33,5	69,5	182/190/186			148
			357		507	33,5	70,0	184/190/186			149
			353		502	33,5	69,5	184/182/184			148

La Societé Kuźnia Jawor garantit que tous les produits objet du présent certificat, respectent en leur totalité les prescriptions de l'Article 15 de l'Arrete Ministériel du 24 mars 1978 modifié C ≤ 0,25%, P < 0,05%, S < 0,05%,
R ≤ 700 N/m², E ≤ 0,9xR,
A% (L_o= 5,65 $\sqrt{S_o}$) min 16% en long. R(A-2) ≥ 10500
A% (L_o= 5,65 $\sqrt{S_o}$) min 14% en transv RxA ≥ 10500"

Besichtigung und Abmessungen o B
Visual inspection and measurement w O
Inspection et Vérification des dimensions w o

Die gestellten Anforderungen sind erfüllt
The a m results meet the requirements
Les exigences posée sont accompelles

Den, Werksachverständiger
2002.01.14
Z ŁAZARZ

Auf die Gegenzeichnung wird gem. Schreiben vom 10 03.2000
Des TÜV Bayern Hessen Sachsen Sudwest e V verzichtet

K18-02.00 11

Data verified and accepted
Indufil QA-Depart...

This is a true copy of the original certificate.
QC: INDUFIL B.V.

DELCORTE S.A.
RACCORDS ACIER-STEEL FITTINGS

17, Avenue du Corbeau - BP 597
59605 MAUBEUGE CEDEX FRANCE
Tél : 27 69.14.14 Fax : 27.64.25.69

CERTIFICAT DE RECEPTION - ACCEPTANCE CERTIFICATE (DIN 50049 3.1.b -EN 10204 3.1.b)

Customer : **COMBORI N.V**
BLANCEFLOERLAAN 181
B.2050 ANVERS
BELGIQUE

Order : **80136**

Certificate n° : **090283 / 1** **29/11/2001**

Dispatch note **090283** **29/11/2001**

Material specification **ASTM A105/98**

Heat Treatment ***NORMALIZED T° C 843-927***

DESCRIPTION

Item	Qty	Designation	Heat N°	Identification	Spec dimension				Localisation
50	5 000	BOUCHON MTH NPT 6M1/2"	C39296	C39	ASME B16.11/91				11/97 11869

CHEMICAL ANALYSIS

Item	Identif.	C %	Si%	Mn%	P%	S%	Cr%	Mo%	V%	Ni%	Cu%	Cb%			
mini			0.100	0.600											
maxi		0.250	0.350	1.350	0.035	0.040									
50	C39	0.190	0.125	0.900	0.013	0.036	0.180	0.020	0.001	0.110	0.200	0.001			

MECHANICAL TESTS

Item	Identi-fication	Re 0.2% N/mm²	Rm N/mm²	A%	Z%	HB	
mini		250.0	485.0	22.0	30.0		
maxi						187	
50	C39	412.0	542.0	25.0	65.0	171	

Data verified
and accepted
Indufil QA-Depart...

Nous certifions que les produits énumérés ci-dessous sont conformes aux prescriptions de la commande et des spécifications et ont subi, sans objection, les contrôles d'aspect et de dimensions.
We hereby certify that above mentioned products are in accordance with the requirements of the order and specifications and have been checked without objection for surface and dimensionnel control.

Quality département

This is a copy of the original certificate.

QC: INDUFIL B.V.

HEERBAART JONGMAN METAAL B.V.

Binnenhavenstraat 37
7553 GH Hengelo(O) – The Netherlands
PO BOX 1136 7750 BC Hengelo (O)
Tel. +31 – (0)74 – 256 26 26
Fax. +31 – (0)74 – 256 26 20

Fabriekscertificaat
Workscertificate
DIN 50049 / 3.1B

Indufil b.v.
Postbus 442
6900 AK Zevenaar

NR. 3103/9865

Fabriksstempel:
Mark of factory:

Uw order nr: 0540/03
Your ref:

Ons order nr: 30547
Our ref:

Persoonlijk stempel:
Personal mark:

Overstempeling is uitgevoerd overeenkomstig de originele merken.

Restamping has been carried out in accordence with the original marks.

Item Pos. Nr.	Aantal Quan-tity	Artikel Article	Materiaal Material	Charge heat Nr.	proef test nr.
1.	8 x	Spectacle blind 2"SAE-3000PSI vigs tek. 033.00.235.08	1.4404	E907002	
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

Item Pos Nr.	Zie aangehecht certificaat leverancier Basismateriaal *See attached certificate of basematerial supplier*
1.	Certnr. 99/0037269 dik 10 mm
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Gecontroleerd door
Inspection by

N.Oostendorp

Handtekening,
Signed,

Hengelo Ov 31 maart 2003

This is a true copy of the original certificate.

QC: INDUFIL B.V.

ALZ naamloze vennootschap
Maarschappelijke zetel
Genk Zuid Zone 5A, B 3600 Genk
Tel. (089) 30 21 11 Telefax (089) 30 23 80
Telex 39058 alzgzj b
H.R. Tongeren nr 41 051 - B.T.W. nr BE 401.277 814

Certificate of test – Mill certificate No 99/0037270
Certificat de Réception C.C.P.U. Nr
Abnahmeprüfzeugnis B
nach DIN 50049/3.1.B - NFA 00001/3.1.B - EN 10204/3.1.B

Approved as supplier according to AQ/WQ - TRD 100 statement W E 603
Überprüfung als Hersteller nach AQ/WQ - TRD 100 Bericht W E 603

PROD.PROCES. Electric Arc Furnace - VOD - Continuous Casting
PROC. FABRIC. Four à Arc - VOD - Coulée Continue
FERTIGUNGSABL.: Elektro-Lichtbogen Ofen - VOD - Strangguss

Der TÜV Rheinland hat mit Schreiben vom 21. März 1972 auf die Gegenzeichnung verzichtet

SURVEYOR'S MARK
CACHET DE L'EXPERT
STEMPEL DES WERKSSACHVERSTÄNDIGEN

your order n° - votre n° de cde - Bestell Nr	our order n° notre n° de cde - Werksnr
80598 R981120	57413/010/12

ROESTVRIJ STAAL, PLATEN, WARMGEWALST, UITGEGLOEID EN GEBEITST

heat n°-n° coulée Schmelze Nr	coil n°-n° bobine Band Nr
E 907002	90700231

Specifications - Spécifications - Vorschriften	Type - Nuance - Quality	Finish	Corrosion test - Corr. inter - Interkrist.Korr.
ASTM A240/A240M-98A ASME SA 240-98	TYPE 316L TYPE 316L	NO 1 NO 1	ASTM A262 E - 93A :OK

dimensions - Abmessungen
mm 10.00 1500.00 3000.0
inches

Material (Code Designation)
Matière
Werkstoff
(Normbez.)

Quenching ASTM A240 forced air
Hypertrempe 1050°c air poussé
Abschreckung bewegter Luft

Particular requirem. - Prescr. particul. - Sondervorschriften

CHEMICAL ANALYSIS
COMPOSITION CHIMIQUE
CHEMISCHE ZUSAMMENSETZUNG

ELEMENTS	LADLE ACIERIE SCHMELZE	PRODUCT PRODUIT STUCKANAL.
C	0.024	0.023
Mn	1.30	1.29
P	0.032	0.031
S	0.004	0.004
Si	0.47	0.48
Cr	17.02	17.05
Ni	11.15	11.18
Mo	2.06	2.05
Cu		
Ti		
Ca		
N	0.021	
δ - ferrite	-	

MECHANICAL PROPERTIES - PROPRIETES MEC. - MECH WERTE

TENSILE TEST ESSAI DE TRACTION ZUG VERSUCH	ROOM TEMP. - TEMP. AMB. - RAUMTEMP			TEMP °C	
	REQ.-EXIGE ANFORDERUNG	OBTAINED - OBTENU - ERGEBNISSE TEST N° - N° TEST - PROBE		REQ.-EXIGE ANFORDER.	OBTAIN.-OBTENU ERGEBNISSE
ASTM A240	N/MM2 min. max.	90700231 A (D) E		min.	
Section - S.Schnitt mm²		12.41X 9.80			
yield limite él Str.grenze 0.2% 1.0%	170	329	330		
tensile strength rupture Zugfestigkeit	485	555	556		
elong. % A50 allong. Br.Dehn.	40	57	58		
ε 0.2 /R max %		59	59		
hardness dureté Härte HRB	95	84.0	85.0		

grain size astm
grain astm
Korngrösse

bend
pliage
Biegeversuch 180° OK

impact strength tes. °C
essai de résilience
Kerbschlagbiegeversuch

TESTS TO VERIFY BATCH AND QUALITY HAVE BEEN CARRIED OUT
TESTS DE VERIFICATION DE LA CONFORMITE DE LA NUANCE FOURNIE
VERWECHSLUNGSPRÜFUNG WURDE DURCHGEFÜHRT OK

VISUAL INSPECTION AND DIMENSIONAL CHECK
EXAMEN VISUEL ET DIMENSIONEL DE SURFACE
BESICHTIGUNGEN UND ABMESSUNGEN VISUELE OPPERVLAKTE KONTROLE EN TOLERANTIES BEOORDEELD OK

QUANTITY / WEIGHT MEMO / QUANTITÉ MÉMO POIDS LIVRÉ
ÜBERSICHT GELIEFERTER GEWICHTE

PACKAGE Nr N° DE CAISSE PAKET NR	QTY. QTÉ. ANZ.	NET WEIGHT POIDS NET NETTO GEW.	PACKAGE Nr N° DE CAISSE PAKET NR	QTY. QTÉ. ANZ.	NET WEIGHT POIDS NET NETTO GEW.
90304611	8	2800			
TOTAL/GESAMT.	QTY. QTÉ ANZ 8		NET WEIGHT POIDS NET NETTO GEW.	2800	

PACKING LIST 913330 - NL - 9905795

The delivery is in accordance with the order.
La fourniture est conforme aux exigences de la commande.
Die Lieferung entspricht den Bestellbedingungen.

RICHTER STAALSERVICE B.V.
POSTBUS 208
7500AE ENSCHEDE
NEDERLAND

Data ver...
and accepted
Indufil QA-Depar...

ALZ naamloze vennootschap
THE SURVEYOR - L'EXPERT - DER WERKSSACHVERSTÄNDIGE

Genk the / le / den 31.03.1999

This is a true copy of the original certificate.

H. JANSSEN
QC: INDUFIL B.V.

OMC Raccordi

RACCORDERIA FORGIATA ACCIAI AL CARBO
LEGATI - INOX
FORGED FITTINGS IN CARBON STEEL
ALLOY STEEL - STAINLESS STEEL
29010 CALENDASCO (Piacenza) - ITALY
VIA ANCONA, 25 - (zona Ind.)
TEL. (0523) 780841/2 - FAX (0523) 788880

INSPECTION CERTIFICATE DIN 50049/3.1B - EN 10204/3.1 / CERTIFICATO DI COLLAUDO

COMBORI N.V.
BLANCEFLOERLAAN, 181
2050 B- ANTWERPEN BELGIUM BE

N.: 557/ 17/10/2001
INVOICE/FATTURA: 701/ 17/10/2001
S.: 4376
DEL NOTE/BOLLA: 585/V 17/10/2001

PAG.: 1

HEAT CODE COD. COLATA	HEAT COLATA	ITEM POS.	YOUR P.O. VS. ORDINE	OUR REFERENCE NS. ORDINE	QUANTITY QUANTITÀ	DESCRIPTION DESCRIZIONE	DIM. IN ACCORDANCE TO DIM. IN ACCORDO A	VISUAL & DIMENSIONAL VISIVO E DIMENSIONALE
	79460	0030	84645	21000454 0004	850	ASTM A105 COUPLING 3000NPT SCRD 1/2"	SEE NOTE	SATISFACTORY
D10	1589	0001	88403	21000465 0002	1300	ASTM A105 HEX H.PLUG 3000NPT SCRD 3/4"	SEE NOTE	SATISFACTORY

HEAT CODE COD. COLATA	HEAT COLATA	ITEM POS.	MATERIAL MATERIALE	C%	Si%	Mn%	S%	P%	Cr%	Ni%	Mo%	Ti%	Cu%	V%	Nb%	N%	Al%	C.E.%	STEEL MILL ACCIAIERIA
	79460	0030	ASTM A105	0.190	0.250	0.870	0.017	0.010	0.070	0.060	0.010	0.000	0.180	0.001	0.000	0.000	0.000	0.367	
D10	1589	0001	ASTM A105	0.195	0.080	0.750	0.004	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	

HEAT CODE COD. COLATA	HEAT COLATA	ITEM POS.	TEST SPECIMEN PROVETTA SECTION Sezione	TEST SPECIMEN PROVETTA LENGHT Lunghezza	YIELD POINT Snervamento N/mm² to 0.2%	TENSILE STRENGHT Rottura N/mm² to	ELONGATION Allungamento % to	REDUCTION IN AREA Contrazione % to	HARDNESS Durezza Hb	BEND TEST Piega	FLATTENING TEST Schiacciam.	IMPACT TEST - resilienza Joule / cm² U.N.	IMPACT TEST TYPE TIPO	IMPACT TEST °0	IMPACT TEST 1	IMPACT TEST 2	IMPACT TEST 3	SHAPE FORMA 1=Ø 2=□ 10x10 mm	S	W	X	YIELD POINT SNERVAMENTO N/mm² to 1.0%	DUR. REF.
	79460	0030	0.00	0.00	313.0	504	33.1	57.9	160-166	0.0	0.0			0	0	0	0					0.0	
D10	1589	0001	0.00	0.00	412.0	0	37.5	74.2		0.0	0.0			0	0	0	0					0.0	

HEAT CODE COD. COLATA	HEAT COLATA	ITEM POS.	MATERIAL IN ACCORDANCE TO MATERIALE IN ACCORDO A	HEAT TREATMENT TRATTAMENTO TERMICO	FURNACE FORNO
	79460	0030	ASME SA-ASTM A105-98	NORMALIZED at 900 C Air Cool	ELETTRIC FURNACE
D10	1589	0001	ASME SA-ASTM A105-98	NORMALIZED at 900 C Air Cool	ELETTRIC FURNACE

Data verified and accepted
Indufil QA-Department

NOTE
ANSI/ASME B16.11 B1.20.1 B31.1 B36.10M B36.19M MSS SP-25 SP-79 SP-83 SP-95:BS3799- NACE MR0175

QUALITY CONTROL DEPARTMENT / UFFICIO CONTROLLO QUALITÀ: OMC RACCORDI S.r.l. QUALITY CONTROL DEPT.
INSPECTION AUTHORITY / ENTE UFFICIALE COLLAUDO:
MANUFACTURER'S SYMBOL / MARCHIO PRODUZIONE: OMC

QC:
This is a true copy of the original certificate.
INDUFIL B.V.

Red Point ALLOYS BV

SPECIALISTS IN TITANIUM AND NICKEL ALLOYS

Radonstraat 2
2718 TA Zoetermeer
The Netherlands
Telephone: +31-793632070
Telefax: +31-793611088
E-mail: info@redpoint.nl
Internet: www.redpoint.nl
Bank: ABN-Amro Zoetermeer
Acc.nr.: 51.93.44.014
VAT nr.: NL 804772332B03

Declaration of remarking: 13235-1
Red Point reference: 37711
Item no.: 1
Customers reference: 0100/03
Date: 29-01-03

Declaration of remarking for: **Indufil B.V.**

Product:	FLANGE CONN.3/4" 600lbs 1"SAE ID-033.00.169.02/B C22.8N TYPE 2
Quantity:	40
Basematerial specification:	C22.8N
Certified to:	EN 10204/3.1.B
Additional testing:	*No*
Product specification:	C22.8N
Original marking:	55808 C22.8N NMH
Basematerial description:	BAR Ø 120 C22.8N
Basematerial manufacturer:	NMH
Certificate number:	82379-3
Red Point certificate:	022935
New Marking:	55808 3/4" 600lbs 1"SAE C22.8N

Products are marked with the information as stated in the column "New Marking".
We hereby certify that the products are manufactured from the material as stated above.

Red Point Alloys BV

H.J.M. van Vijk
Quality Assurance Manager

This is a true copy of the original certificate.

QC: INDUFIL B.V.

Lloyd's Register

Certificate no: STU 0202666/1

Project: unknown

Client:

Office: Stuttgart

Clients Order Number: 100830 dd. 02.08.2002

Date: 30 Oct 2002

Order Status: complete

Inspection Dates
First: and

Final: 18 Oct 2002

This certificate is issued to

the above client to certify that the material described below has been tested and inspected in presence of the undersigned LR Surveyor at NMH Stahlwerke GmbH, Sulzbach-Rosenberg, Germany, their Works Order No. 82379/3

-10-	ROUND BAR(S) 120 mm dia.
Quantity	Material Quality: C22.8N/A105/SA105, hot rolled, normalised in accordance with attached Works Test Certificate No. 406

SPECIFICATION
Lloyd's Register Rules and Regulations for the Classification of Ships and Standards as indicated on Works Test Certificate No. 406

SCOPE OF INSPECTION
Witnessed physical tests: for results see attached Works Test Certificate
Scrutinised the manufacturer's declared chemical composition
Scrutinised the manufacturer's records of heat treatment
Checked dimensions at random
Visual inspection
Marked material for identification purposes

Identification Marking on each bar:

NMH
C22.8N/A105/SA105
Cast No., Test No.
US
LR STU GM

re

R. Kiel for G. Münchberg
Surveyor to Lloyd's Register of Shipping

This is a true copy of the original certificate.

QC: INDUFIL B.V.

Stahlwerke GmbH i.K.

Abnahmeprüfzeugnis
Inspections certificate

(DIN EN 10204 -3.1B)

NMH Stahlwerke GmbH, Postfach 1344, 92231 Sulzbach-Rosenberg

023091

Data verified and accepted
Indufil QA-Department

Ihre Bestellung-Nr. / vom 100830		Your order No./of: 02.08.2002	
Unsere Auftrags-Nr. Our order No./item:	82379 - 3	Freigabetag date of release	
Werkstoffbezeichnung Material designation	C22.8N/A105/SA105		
Abmessung dimension	120 mm	rd./round	
Freigabemenge weight	9870	Stückzahl quantity	10
Erschmelzungsprozeß / melting process	Sauerstoffblasverfahren / Y		
Erzeugnisform type of product	Strangguss gewalzt / rolled from co-materials		
Lieferzustand heat treatment	normalisiert/normalized		
Schmelze heat No.	55808		
Umformgrad degree of deformation	12.17		
Zeichen des Herstellwerkes manufacturer's symbol	NMH	Zeichen des Werkssachverständigen inspector's symbol	NMH R

Lieferung erfolgte nach technischer Vorschrift:
according to technical regulations No.: DIN17243,EN10222-2,DIN1013,ASTM A105,ASME SA105

AD-W13,TRB100,TRD107,LRS rules 2000 P.2,Ch.5,S.3

Sonstige Vermerke:
other remarks: Wärmebehandlung: 950°C, 2h Abn.Nr. 406 Zugpr.durchm. 14 mm

Chemische Zusammensetzung in % *Chemical composition in %*

C	Si	Mn	P	S	Al	Cr	Ni	Mo	V	Cu	As
0,21	0,28	0,89	0,014	0,002	0,026	0,22	0,07	0,02	0,01	0,14	0,007
Sn	N	B	Ti	Nb	Ca	O	H			CE-Wert	DI-Wert
0,006				0,013						,422	

Mechanische Eigenschaften *Mechanical properties*

Behandlungszustand der Proben: *normalisiert/normalized* *unbehandelt*
conditions of treatment:

Probennr. sample No.	Probenlage sample direction	°C	ReH N/mm²	Rm N/mm²	A in %	Z in %	Kerbschlagarbeit *Impact value* ISO-V=Charpy-V							
							Probennr.	Probenlage	Probenform type of test piece	°C	J	J	J	φ J	J/qcm
31k	l	20	356	528	25.4	64.9	31k	l	ISO-V	20	178	166	152	165	
31f	l	20	355	531	25.6	64.9	31f	l	ISO-V	20	170	172	180	174	
32k	l	20	338	522	26.4	66.5	32k	l	ISO-V	20	145	164	139	149	
32f	l	20	353	522	28.1	66.5	32f	l	ISO-V	20	179	176	178	178	

Festigkeit / hardness

Anlieferungsfestigkeit: 149 HB
supplying hardness

Normalisierungsfestigkeit:
normalized hardness

Austenitkorngröße:
austenit corn size

Mikroreinheitsgrad K4 - Methode: Sulfid Oxid Gesamt
micro degree of purity total

US-Prüfung
ultrasonic test
100%US-geprüft n. SEP1920-3C
ohne Mängel

Verwechslungsprüfung
mixing up test
100% geprüft
ohne Mängel

Riß-Prüfung
flaw detection

Stirnabschreckversuch *Jominy test*

Härteentg. mm hardening dist.																

Anforderungen: Re >= 250 N/qmm, Re +450°C >= 70 N/qmm, Rm 485-640 N/qmm, A >= 19%, K ISO-V >= 31J
Lieferlängen: 7 x 11.10 m , 2 x 11.15 m 1 x 11.20 m

18.10.02, NMH Stahlwerke GmbH, Qualitätsstelle
Werkssachverständiger Renner

This is a true copy of the original certificate

QC: INDUFIL B.V.

NMH Stahlwerke GmbH i.K.

Abnahmeprüfzeugnis
Inspections certificate
(DIN EN 10204 -3.1B)

NMH Stahlwerke GmbH, Postfach 1344, 92231 Sulzbach-Rosenberg

023091-1

Ihre Bestellung-Nr. / vom Your order No./of:	100830
Unsere Auftrags-Nr. *Our order No./item*	82379 -3
Freigabetag *date of release*	
Werkstoffbezeichnung *Material designation*	C22.8N/A105/SA105
Abmessung *dimension*	120 rd./round
Freigabemenge *weight*	9870 10
Erschmelzungsverfahren *melting process*	Sauerstoffblasverfahren / Y
Erzeugnisform *type of product*	Strangguss gewalzt / rolled from cc-materials
Lieferzustand *heat treatment*	normalisiert/normalized
Schmelze *heat No.*	55808
Umformgrad *degree of deformation*	12.17
Zeichen des Herstellwerkes *manufacturer's symbol*	NMH
Zeichen des Werkssachverständigen *inspector's symbol*	NMH R

Fortsetzung der mechanischen Eigenschaften Mechanical Properties continued

Probennr. *sample No.*	Probenlage *direction*	°C	ReH N/mm²	Rm N/mm²	A in %	Z in %	Kerbschlagarbeit Impact value Probennr	Lage	Probenform	°C	J	J	J	Ø J	J/qcm
932	l	450	202												

LR ITU

J. Piner

LLOYD'S REGISTER OF SHIPPING STUTTGART 18/10/02

Dieses Zeugnis wurde maschinell erstellt.
This certificate was machine-made.
16.10. 200 , NMH Stahlwerke, Qualitätsstelle
Werksachverständiger Renner

Seite 2/2

Data verified and accepted Indufil QA-Department

This is a true copy of the original certificate.
QC: INDUFIL B.V.

Red Point ALLOYS BV

SPECIALISTS IN TITANIUM AND NICKEL ALLOYS

Radonstraat 2
2718 TA Zoetermeer
The Netherlands
Telephone: +31-79361 1255
Telefax: +31-7936 11088
E-mail: info@redpoint.nl
Internet: www.redpoint.nl
Bank: Rabobank Montfoort
Acc.nr.: 13.46.85.040
VAT nr.: NL 804772332B03

Declaration of remarking: 11338-1
Red Point reference: 36156
Item no.: 1
Customers reference: 2084/01
Date: 15-10-01

Declaration of remarking for:	**Indufil B.V.**
Product:	FLANGE CONN 3/4"SW-1"SAE ID-033.00.028.02/A Type 1 C22.8N
Quantity:	20
Basematerial specification:	C22.8N/A105N
Certified to:	EN 10204/3.1.B
Additional testing:	No
Product specification:	C22.8N/A105N
Original marking:	103990 C22.8N/A105N HUTA
Basematerial description:	BAR Ø 90 C22.8N
Basematerial manufacturer:	HUTA
Certificate number:	3323/45/98
Red Point certificate:	021168
New Marking:	103990 3/4"-1"sae C22.8N/A105N

Products are marked with the information as stated in the column "New Marking".
We hereby certify that the products are manufactured from the material as stated above.

Red Point Alloys B.V.

H.J.M. van Wijk
Quality Assurance Manager

This is a true copy of the original certificate.

QC: INDUFIL B.V.

021168

ODS-NR:
004992

Lloyd's Register

Project: ROLLED BARS

Certificate Number: KAT 9800033/7

Client: HUTA LUCCHINI-WARSZAWA
Warszawa

Office: Katowice

Client's Order Number: PL/271936361/08-3110

Date: 16.09.98

Order Status: Complete

Inspection Dates
First: 03.09.98

Final: 11.09.98

This certificate is issued to HUTA LUCCHINI-WARSZAWA to certify that the undersigned Surveyor did at their request attend their works at Warzsawa , Poland for the purpose of examining the material listed below made under works order No.726977/98.

Description:
Rolled bars, grade C22.8/ A-105, normalized.

Size (mm)	Pcs	Weight (kgs)	Heat No. / Test No
ø 90 x 5000-6000	23	6400	103990/696

The following scope of inspection was acrried out against order and specification requirements.

1. Selected test samples and witnessed mechanical tests.
2. Reviewed declared chemical analyzis.
3. Carried out dimensional examination.
4. Carried out visual inspection.
5. Checked ultrasonic test reports-satisfactory.

The test results of mechanical properties and chemical composition are listed on page 2.

For identification stamped:

LR KAT 9800033 M. F.

Data verified and accepted
Indufil QA-Department

p.1/2

ORIGINEEL

M. Plutkowski
Surveyor to Lloyd's Register

NOTICE: This certificate is subject to the terms and conditions overleaf, which form part of this certificate.

 Lloyd's Register of Shipping, registered office: 71 Fenchurch Street, London EC3M 4BS

This is a true copy of the original certificate.
QC: INDUFIL B.V.

MATERIAL PROPERTIES: CASTINGS, FORGINGS OR ROLLED STEEL PRODUCTS

LR Office: Katowice

Continuation of Certificate number: RAT 98000373/7

02168-1

MECHANICAL PROPERTIES

CAST NUMBER	TEST NUMBER	TENSILE TEST: DIRECTION OF TEST	YIELD STRESS N/mm²	TENSILE STRENGTH N/mm²	ELONGATION %	REDUCTION OF AREA %	IMPACT TEST ISO V: DIRECTION OF TEST	SPECIMEN SIZE	TEST TEMP °C	JOULES			AV.	HARDNESS TYPE
103990	696	L	320	516	31.3	69.0	L	10 x 8 mm	-20	150	145	148	148	

Data verified & accepted
Lloyd's Register

Remarks: ORGINEEL

Signature - Surveyor to Lloyd's Register of Shipping: M.Finkowski

CHEMICAL COMPOSITION AND HEAT TREATMENT

CAST NUMBER	COMPOSITION OF LADLE SAMPLES % - AS STATED BY THE MANUFACTURER: C	Mn	Si	P	S	Al	Nb	V	Ti	Ni	Cu	Cr	Mo			HEAT TREATMENT
103990	0.21	0.84	0.28	0.009	0.012	0.029	0.002	0.002		0.12	0.27	0.07	0.02			Normalized

NOTICE: This certificate is subject to the terms and conditions overleaf which form part of this certificate.

HUTA L.W. Sp. z o.o.
ul. Kasprowicza 132
01-949 Warszawa
fax 354222, 340952
tlx 82-53-51

INSPECTION CERTIFICATE
ABNAHMEPRÜFZEUGNIS
DIN 50049/3.1.B

Date / Datum: 1998. 09.11
N. Certificate / Zeugnis Nr: 3323/45/98

Purchaser / Besteller: **ODS B.V.**
Postbus 69
2990 AB Barendrecht
Holland

Purchaser order / Bestellnummer: PL/271936361/08-3110

Confirmation N. / Bestätigung Nr: 726977/98

Profile and size / Sortiment und Abmessung	Steel grade / Stahlqualität	Heat / Charge	Weight / Gewicht	Bundles / Bunde	coils / Ringe	bar / Stäbe
Hot rolled bars Warmgewalzt-Stahl Ø 90 x 5000-6000 mm	C22.8/A-105	103990	6.400	3		23

Delivery conditions / Lieferzustand: ; normalized
DIN 1013
AD-W13, TRD 107, AD-WO/TRD-100
DIN 17243 SEL 055E cl.2

Notes / Bemerkungen: LRS - KAT 9800033

Chemical analysis / Chemische Zusammensetzung

C	Mn	Si	P	S	Cr	Ni	Cu	Mo	Al
0.21	0.84	0.28	0.009	0.012	0.07	0.12	0.27	0.02	0.029

V-0.002 Nb-0.002

Mechanical properties / Mechanische Eigenschaften

Test N / Probe Nr	Re N/mm²	Rm N/mm²	A %	Z %	Impact test / Schlagarbeit	Heat treatment test specimens / Wärmebehandlung der Probe
696	370	515	31.5	69.0	ISO-V +20°C 150 145 148	Hardned °C Tempered °C Normaliz Cair

Hardness / Härte

Others / Andere

Austenite grain size / Austenit Korngröße

Macro test / Makrostruktur

Microinclusions / Mikroeinschlüsse

Ultrasonic examination / Ultraschallprüfung: SEP 1920 cl.B gr.3 - O.K

ORIGINEEL

Data verified and accepted Indufil QA-Department

Hardenability Jominy test / Härtbarkeit

Decarburization / Entkohlung	Microstructure / Mikrostruktur	Hardness after hardening / Härte nach dem Härten	Spark test / Funkenprobe
		Water / Wasser — Oil / Öl	100%

Certification office / Zertifikatbüro
H.L.W. BIURO ATESTÓW
Certification office

HUTA L.W. Ltd
INDEPENDENT QUALITY SUPERVISOR
Eng Jerzy Gedronowicz

This is a true copy of the original certificate.
QC INDUFIL B.V.

Red Point ALLOYS BV

SPECIALISTS IN TITANIUM AND NICKEL ALLOYS

Radonstraat 2
2718 TA Zoetermeer
The Netherlands
Telephone: +31-793611255
Telefax: +31-793611088
E-mail: info@redpoint.nl
Internet: www.redpoint.nl
Bank: Rabobank Montfoort
Acc.nr.: 13.46.85.040
VAT nr.: NL 804772332B03

Declaration of remarking: 12502-1
Red Point reference: 36948
Item no.: 1
Customers reference: 1211/02
Date: 14-08-02

Declaration of remarking for:	**Indufil B.V.**
Product:	FLANGE CONN.3/4"300#-1"SAE ID-033.00.133.02/C Type 2 C22.8N
Quantity:	40
Basematerial specification:	C22,8N
Certified to:	EN 10204/3.1.B
Additional testing:	No
Product specification:	C22,8N
Original marking:	122077 C22,8N HUTA L.W. LTD.
Basematerial description:	BAR Ø 120 C22.8N
Basematerial manufacturer:	HUTA L.W. LTD.
Certificate number:	34571/2001
Red Point certificate:	022255
New Marking:	122077 3/4"300#-1"SAE C22,8N

Products are marked with the information as stated in the column "New Marking".
We hereby certify that the products are manufactured from the material as stated above.

Red Point Alloys BV

H.J.M. van Wijk
Quality Assurance Manager

This is a true copy of the original certificate.

INDUFIL B.V.

cc:

Lloyd's Register

Project: ROLLED BARS | *Certificate Number:* KAT 0100159/1

Client: HUTA LUCCHINI-WARSZAWA | *Office:* Katowice

Works Order/Confirmation Number: 778780/2001 | *Date:* 19.11.2001

Order Status: Complete

Inspection Dates
First: 14.09.2001 | *Final:* 13.11.2001

This certificate is issued to HUTA LUCCHINI-WARSZAWA to certify that the undersigned Surveyor did at their request attend their works at Warszawa, Poland for the purpose of examining the material listed below made under works order No. 778780/2001 intended for Centrozap S.A.

Description :

Rolled bars, grade C22.8 acc. to DIN 17243, normalized.

Size (mm)	Pcs	Weight (kgs)	Heat No./Test No.
ø 120 x 5000	12	5460	122077 / 170

The following scope of inspection was carried out against order and specification requirements.

1. Selected test samples and witnessed mechanical tests.
2. Reviewed declared chemical analysis.
3. Carried out dimensional examination at random (5%).
4. Carried out visual inspection at random (10%).
5. Reviewed ultrasonic test reports.

The test results of mechanical properties and chemical composition are listed on page 2.

The material described above is considered to comply with the order confirmation No. 778780/2001

Identification No. 01.1984

For identification stamped :

LR KAT 0100159, Heat No., Test No., Dia., Grade, B H

p.1/2

B. Huras
Surveyor to Lloyd's Register

FORM 1103 (11/98) Lloyd's Register of Shipping, registered office 71 Fenchurch Street, London EC3M 4BS

THIS DOCUMENT IS SUBJECT TO THE TERMS AND CONDITIONS OVERLEAF

Data verified and accepted
Indufil QA-Department

This is a true copy of the certificate.
QC: INDUFIL B.V.

MATERIAL PROPERTIES:
CASTINGS, FORGINGS OR ROLLED STEEL PRODUCTS

LR Office	Continuation of Certificate number
Katowice	KAT 0100159/1

MECHANICAL PROPERTIES

CAST NUMBER	TEST NUMBER	TENSILE TEST					IMPACT TEST ISO V							HARDNESS TYPE: HB
		DIRECTION OF TEST	YIELD STRESS N/mm²	TENSILE STRENGTH N/mm²	ELONGATION % A5	REDUCTION OF AREA %	DIRECTION OF TEST	SPECIMEN SIZE	TEST TEMP °C	JOULES 1	2	3	AV.	
122077	170	L	360	520	26.5	64.5	L	10x8mm	20	130	126	132	129	149-152
		L	340	520	27.0	64.0	L	10x8mm	20	129	128	133	130	

Remarks: N/A

Signature - Surveyor to Lloyd's Register of Shipping: B. Hurst

CHEMICAL COMPOSITION AND HEAT TREATMENT

CAST NUMBER	COMPOSITION OF LADLE SAMPLES % - AS STATED BY THE MANUFACTURER															HEAT TREATMENT
	C	Mn	Si	P	S	Al	Nb	V	Ti	Ni	Cu	Cr	Mo			
122077	0.22	0.85	0.23	0.006	0.003	0.022	-	-	-	0.10	0.25	0.05	0.02			Normalized.

HUTA L.W.
Spółka z o.o.
ul.Kasprowicza 132, 01-949 WARSZAWA

ŚWIADECTWO ODBIORU
INSPECTION CERTIFICATE
ABNAHMEPRÜFZEUGNIS
ACCORDING TO EN 10204
3.1.B

Certificate No. Date
34571/2001(1) 2001-11-05

Confirmation No.
778780/2001 **2/**5

Department:
W-45

Contract dated 2001-07-27
PL/010592085/01-1273

Order No/Bestell-Nr
01.1964
dated/Datum
2001-07-25

022255

Purchaser/Käufer (273544270)

CENTROZAP SPÓŁKA AKCYJNA
MICKIEWICZA 29
40-085 KATOWICE
POLSKA

We hereby certify that the quality of the goods is conforming
with standards and other documents marked in this Inspection Certificate.
Wir bestätigen hiermit, daß die gelieferten Erzeugnisse
den Bedingungen der Normen sowie der anderen hier genannten Vorschriften entsprechen.

Article / Gegenstand (GPO)	Delivery conditions / Lieferzustand (N)	Material destination / Materialverwendung (Pkm)
Hot Rolled Round Bars Rundstange warmgewalzt	Normalized Normalisiert	for mechanical working zur mechanische Bearbeit.

Material / Werkstoff C22.8 — standard / normen DIN 17243 — Heat No / Schmelze-Nr 122077

Dimensions / Abmessungen[mm] Diameter / Durchmes. 120 — Manufacturing length from: / Fabrikatlänge von: 5.000 to: / bis: 6.000 [m]

Weight[kg] / Gewicht[kg] 5.460 — Bars / Stäbe 12 — Standards / Normen DIN 1013 DIN 17243

Ladle chemical analysis [%]
Schmelze chemische Zusammensetzung [%]

C	Mn	Si	P	S	Cr	Ni	Cu	Mo	Al
0.22	0.85	0.23	0.008	0.003	0.05	0.10	0.25	0.02	0.022

-Mechanical properties/Impact test according to DIN 50 125 / DIN 50 115
-mechanische Eigenschaften/Kerbschlagzähigkeit entsprechend DIN 50 125 / DIN 50 115

Direction / Richtung	Re [N/mm2]	Rm [N/mm2]	A5 [%]	Z[%]	ISO-V. [J]	Impact test temperature / Kerbschlagzähigkeitprüftemperatur
L	360	520	26.5	64.5	130.0-126.0-132.0	20.0°C
L	340	520	27.0	64.0	129.0-128.0-133.0	20.0°C

-Hardness
-Härte
surface / Fläche HB - 149.0 - 152.0
according to / entsprechend DIN 50351/R6

N-900°C-Luft/air
170/LRS KAT 0100159

Surface defect examination Oberflächenfehlerprüfung
Class 1 according to SEL 055E Klasse 1 entsprechend SEL 055E
Spark test 100% Funkenprobe 100%
Defect exam. SEP1920 cl.B gr.3
ADW 0
ADW 13
TRD 100
TRD 107

Responsible: Quality Management Department
Verantwortlicher: Qualitätssicherungabteilung
2002-01-02 11:48:44

Manager M.Sc.Eng.
Leiter Dipl.Ing. Beata Staniszewska

1/1

GRUPPOLUCCHINI

Data verified
and accepted
Indufil QA-Department

This is a true copy of the original certificate.
QC: INDUFIL B.V.

INDUFIL®

Indufil BV, Nieuwgraaf 79, 6921 RK Duiven, The Netherlands, P.O. Box 442, 6900 AK Zevenaar, The Netherlands.
VAT.No.: NL-802897782 B01, Telephone: +31 26 3190800, Telefax: +31 26 3190808. E-mail: indufil@indufil.com.

IV. CERTIFICATE OF PRESSURE TESTING ZERTIFIKAT FÜR DRUCKPRÜFUNG CERTIFICAT DE TEST DE PRESSION (EN 10204-3.1B)

Customer	Kunde	Client	**TOKYO SANGYO CO. LTD. OSAKA BRANCH**
Purchase ordernr.	Bestell-Nr	No de com. Client	**822-35561 ITEM 1**
Purchase tag nr.	Tag-Nr	No de repère	**CT-9901F1(A/B)**
Indufil ordernr.	Indufil Auftr.-Nr.	No de fabr. Indufil	**2003.1536.1(A/B)**
Subject	Gegenstand	Objet	**IDGL 2-620 - 2"ANSI-300lbs.RF**
Third party reg. nr.	Vorprüfungsnr.	No de reg. du cert.aut	**2007-2008**
Year of manufacture	Herstellungsjahr	Année de construct.	**2003**
Drawing number	Zeichnungsnummer	No de plan	**057.63.096.02.REV.0**

Acceptance standard	Akzeptierung laut	Acceptation standard	**ASME VIII DIV.1 ED'2001 ADD'2002**
Procedure nr.	Prozedur-Nr.	No de procédé	**WI-4.3**
Design pressure acc. Spec.	Auslegungsdruck nach Spez.	Pression d'étude suivant spec.	**22.0 kg/cm²(g)**
Test pressure acc. Spec.	Prüfüberdruck nach Spez.	Pression du test suivant spec.	**--- kg/cm²(g)**
Design pressure std. Calc.	Auslegungsdruck Std. Ber.	Pression d'étude Std. Calc.	**22.0 kg/cm²(g)**
Test pressure Std. Calc.	Prüfüberdruck Std. Ber.	Pression du test Std. Calc.	**33.0 kg/cm²(g) (executed)**
Capacity	Inhalt	Capacité	**8 L**
Test medium	Prüfmittel	Médium d'épreuve	**Potable water**
Test temperature	Prüftemperatur	Temp. d'épreuve	**Ambient (68 °F)**
Test duration	Standzeit	Durée du test	**60 min.**
Pressure gauge	Manometer	Manomètre	**93.1463.1-01**
Test location	Prüfort	Lieu d'épreuve	**Duiven**
Test date	Prüfdatum	Date d'épreuve	**17-06-2003**
Results	Ergebnis	Résultats	**Satisfactory**

Third party / Abnahmeges. / Cert. Aut.	Customer / Kunde / Client	QA Dept / QA Abt. / Service QA
LR INSURANCE INC.	TOKYO SANGYO CO. LTD. OSAKA BRANCH	INDUFIL B.V. Quality assurance Date: 03 JUL 2003 This is a legible copy of the original certificate. Date: 03-07-2003

Industrial Filtration

INDUFIL®

Indufil BV, Nieuwgraaf 79, 6921 RK Duiven, The Netherlands, P.O. Box 442, 6900 AK Zevenaar, The Netherlands.
VAT.No.: NL-802897782 B01, Telephone: +31 26 3190800, Telefax: +31 26 3190808. E-mail: indufil@indufil.com.

INDUFIL®

INDUFIL

THE NETHERLANDS

Manufacturer INDUFIL BV. THE NETHERLANDS.			
Filtertype	IDGL 2-620 2"ANSI-300lbs.RF		
Cartridge	INR-Z-620-A-CC25-V		
Shop nr	*	Year built	2003
Design code	ASME VIII DIV.1	Volume	8 L
Design temperature	Min. -29 °C	Max. 100 °C	
Design pressure	22.0 kg/cm²(g)		
Test pressure	33.0 kg/cm²(g)		
Corrosion allow.	3.0 mm		
Empty Weight	65 kg		
Inspection authority	U-STAMP		
Customer: MISUZU ITEM No.: **			

*	**
20031536.1A	CT-9901F1A
20031536.1B	CT-9901F1B

NAME PLATE INDUFIL B.V.

INDUFIL B.V.
Quality assurance
Date
Signed: T.P.E. Giezen

This is a true copy of the original certificate.

INDUFIL B.V.

INDUFIL®

Indufil BV, Nieuwgraaf 79, 6921 RK Duiven, The Netherlands, P.O. Box 442, 6900 AK Zevenaar, The Netherlands.
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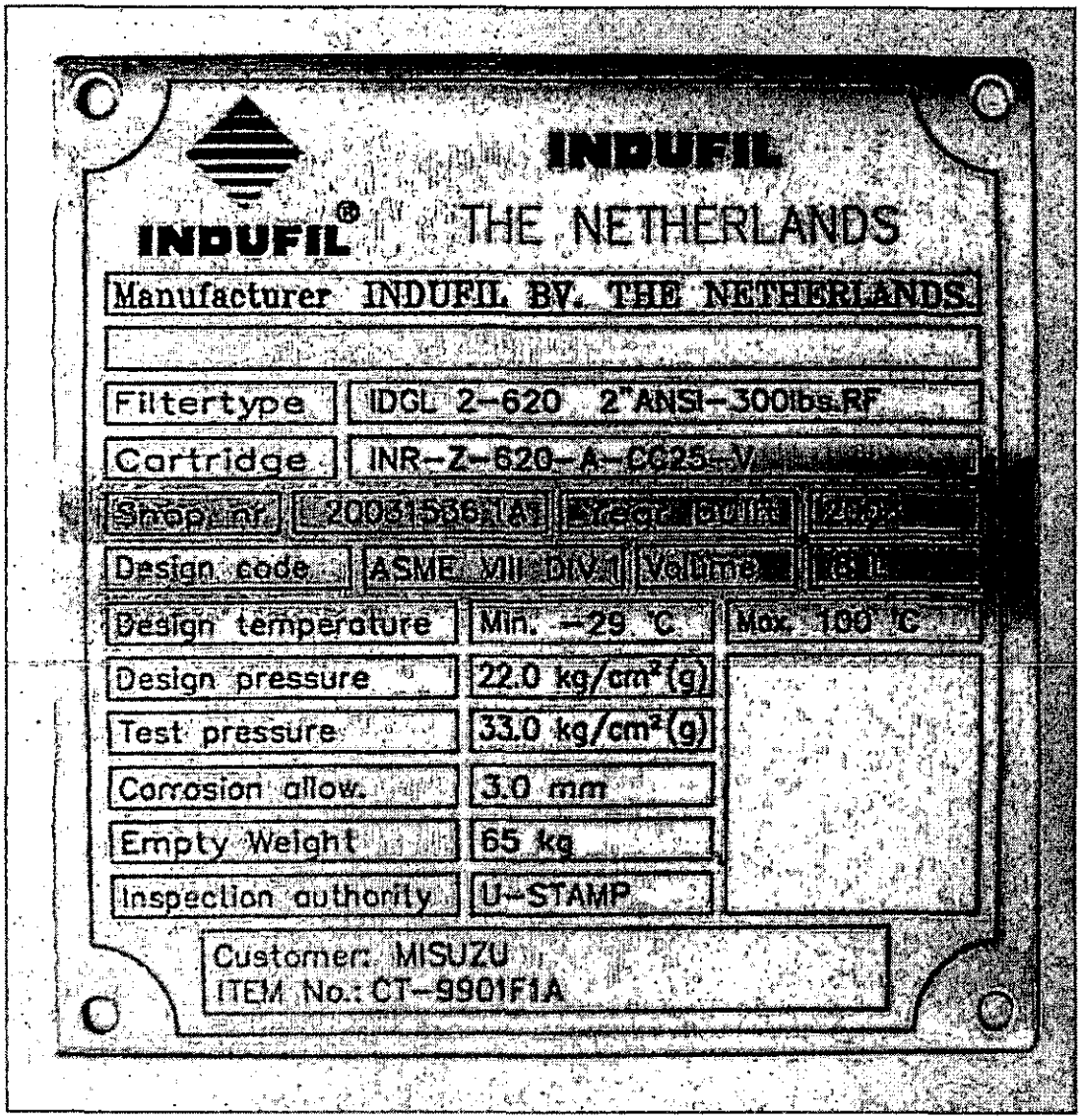

INDUFIL B.V.
Quality assurance
Date 02 JUL 2003
Signed T.P.E. Giezen

Industrial Filtration

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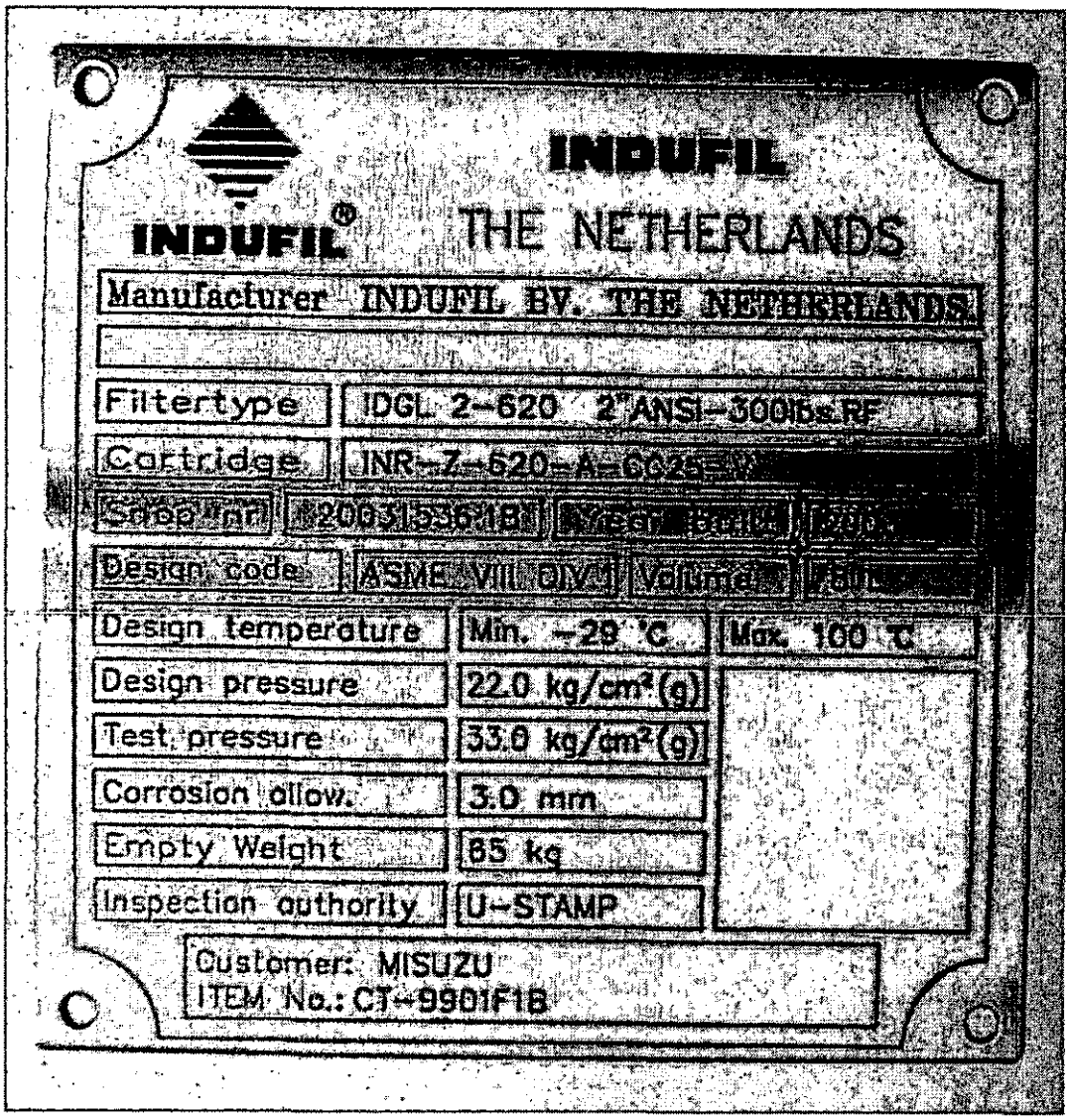

INDUFIL B.V.
Quality assurance
Date 02 JUL 2003
Signed: T.P.E. Giezen

Industrial Filtration

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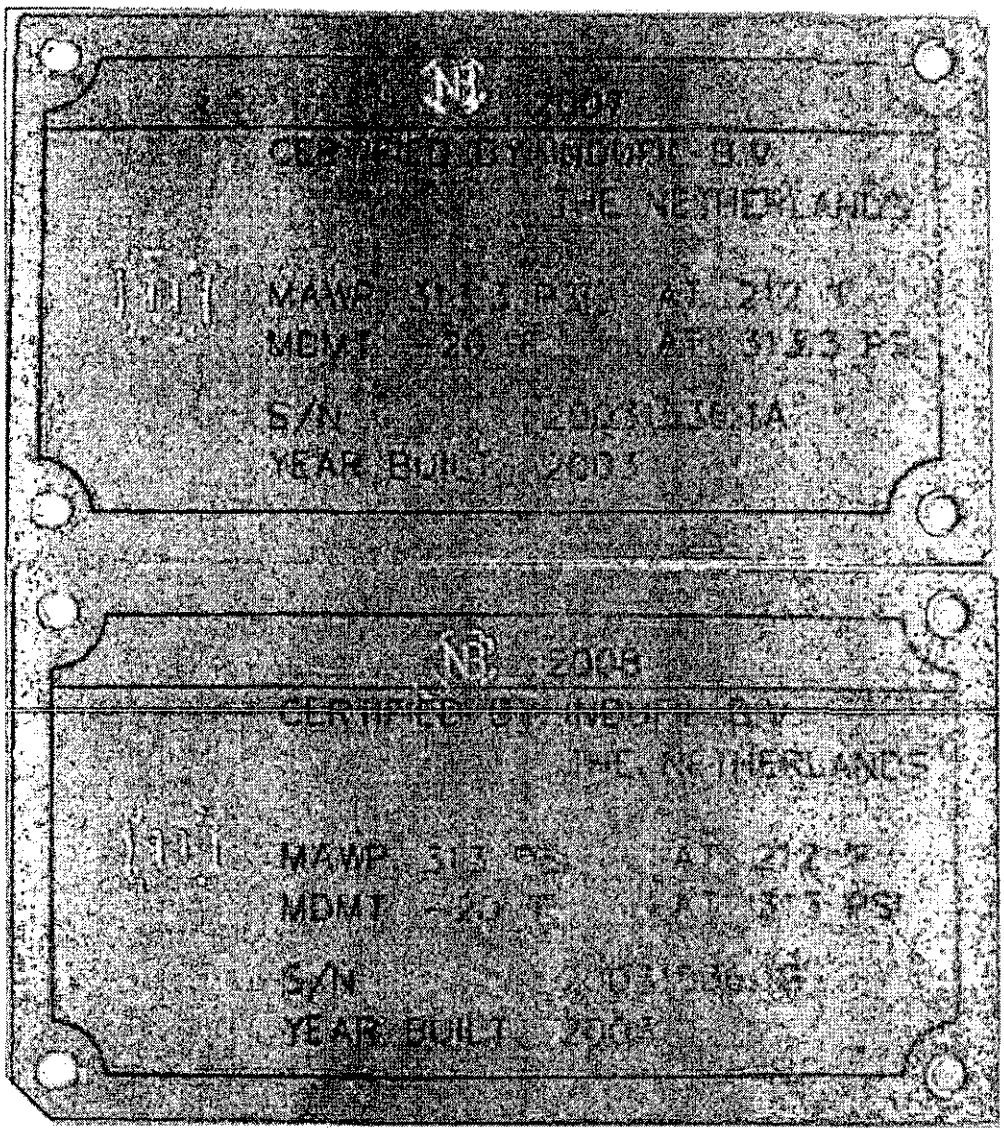

INDUFIL B.V.
Quality assurance
Date 02 JUL 2003

Industrial Filtration

MISUZU

INSPECTION REPORT

CUSTOMER : ELLIOTT EBARA TURBO MACHINERY CORPORATION	EBARA SER. NO. : R021570804
ARTICLE : LUBE OIL CONSOLE UNIT	ITEM NO. : CT-9901/TC-9901
ITEM : ACUMULATOR	SERIAL NO. : U-2549
DRAWING NO. : ER021570804/902 (K1-01692)	INSPECTION DATE : 30th OCT. 2003

CUSTOMER : LG ENGINEERING & CONSTRUCTION CORP.

FINAL USER : TURKISH PETROLEUM REFINERIES CORP.

PROJECT : TUPRAS IZMIR REFINERY DHP PROJECT

JOB. NO. : 7020

SERVICE : RECYCLE GAS COMPRESSOR

ITEM NO. CT-9901D2

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed

EETC Q.C Dept.

Certified by :

Inspected by : H. Tanaka

MISUZU Industrial Corporation

U-2549
CT-990/D2

FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS

(Alternative Form for Single Chamber, Completely Shop or Field Fabricated Vessels Only)
As Required by the Provisions of the ASME Code Rules, Section VIII, Division 1

65

1. Manufactured and certified by Nippon Accumulator Co., Ltd, 415 Nishikubo, Shimizu City 424-0038 Japan
(Name and address of manufacturer)

2. Manufactured for PACIFIC SOWA CO., SHINKAWASANKO-BLDG., 1-3-17, SHINKAWA, CHUO-KU, TOKYO, 104-0033 JAPAN
(Name and address of purchaser)

3. Location of installation Stock
(Name and address)

4. Type	(Mfgr's serial No.)	(CRN)	(Drawing No.)	(Nat'l. Bd. No.)	(Year built)
Hydraulic Acc. (Horiz. or vert., tank)	1633756	N/A	A370986 Rev. 00	30291	2003

5. The chemical and physical properties of all parts meet the requirements of material specifications of the ASME BOILER AND PRESSURE VESSEL CODE. The design, construction, and workmanship conform to ASME Rules, Section VIII, Division 1 2001 (Year)

To	Code Case Nos.	Special Service per UG-120(d)
2002 Addenda (Addenda (Date))	N/A	N/A

6. Shell:	Nom. Thk. (in.)	Corr. Allow. (in.)	Diam. I.D. (ft. & in.)	Length (overall) (ft. & in.)
SA-312 TP304 (Matl. (Spec. No., Grade))	0.512	0.000	1' 2.976"	6' 1.62"

7. Seams: None

Long. (Welded, Dbl., Sngl., Lap, Butt)	R.T. (Spot or Full)	Eff. (%)	H.T. Temp. (°F)	Time (hr)	Girth (Welded, Dbl., Sngl., Lap, Butt)	R.T. (Spot, Partial, or Full)	No. of Courses

8. Heads: (a) Matl. Integral (Spec. No., Grade) (b) Matl. (Spec. No., Grade)

(a) (b) Location (Top, Bottom, Ends)	Minimum Thickness	Corrosion Allowance	Crown Radius	knuckle Radius	Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure (Convex or Concave)
(a)									
(b)									

If removable, bolts used (describe other fastenings) N/A
(Matl., Spec. No., Gr., Size, No.)

9. MAWP 1000 psi at max. temp. 230 °F

Min. design metal temp. 32 °F at 1000 psi. Hydro. ~~pneumatic~~ test pressure 1350 psi.

10. Nozzles, inspection and safety valve openings:

Purpose (Inlet, Outlet, Drain)	No.	Diam. or Size	Type	Matl.	Nom. Thk.	Reinforcement Matl.	How Attached	Location
Gas In/Outlet	1	6.118"	Threaded	SA-312 TP304	0.486"	Integral	Int. Forged	Top
Oil In/Outlet	1	4.252"	*	SA-312 TP304	0.434"	Integral	Int. Forged	Bottom

11. Supports; Skirt NO (Yes or no) Lugs N/A (No.) Legs N/A (No.) Other N/A (Describe) Attach N/A (Where and how)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report: N/A
(Name of part, Item number, Mfgr's name and identifying stamp)

8. For noncorrosive service. 9. Exempted from charpy impact testing per UHA-51(d), Hydro tested in vertical position.
10. Over pressure protection to be installed by user for the oil opening per UG-125(g). Insp. opening; UG-46(e)
Others: Heat No. 1-39071 (JFE Steel Corporation) * Plain end for "O"ring seal. **According to UF-31(a)(1), HT. temp. 1900°F, 24min.

CERTIFICATE OF SHOP/FIELD COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME Code for Pressure Vessels, Section VIII, Division 1. "U" Certificate of Authorization No. 12,594 expires Apr. 30, 20 05.

Date Jun. 24, 2003 Co. name Nippon Accumulator Co., Ltd (Manufacturer) Signed (Representative)

CERTIFICATE OF SHOP/FIELD INSPECTION

Vessel constructed by Nippon Accumulator Co., Ltd at 415 Nishikubo, Shimizu City 424-0038 Japan

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of New York and employed by H.S.B.I & I.Co. of Hartford, Ct.

have inspected the component described in this Manufacture's Data Report on Jun. 24, 20 03, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME Code, Section VIII, Division 1. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date Jun. 24, 2003 Signed (Authorized Inspector) Commissions NB 10015-A, B, [Nat'l Board (incl. endorsements), State, Prov. and No.]

JC-13 1/1

管検査証明書 (INSPECTION CERTIFICATE)

KAWATETSU

川崎製鉄株式会社 知多製造所
KAWASAKI STEEL CORPORATION CHITA WORKS
愛知県半田市川崎町1丁目1番地 〒475-8611
1,Kawasaki-cho 1-chome, Handa-City, Aichi Pref.

日付 DATE : 2002-12-17

証明書番号(送状番号) CERTIFICATE No.(INVOICE No.) : PG3836
需要家発注No. ORDER No. : 80457600
契約番号 CONTRACT No. : 2295-Z1813-01 (AN1 1)
注文者 SHIPPER : KAWASHO CORPORATION
需要家 CUSTOMER : NIPPON ACCUMULATOR CO.,LTD.

納入仕様書番号 M.P.S No. : S140C
規格 SPECIFICATION : ASMESA312TP304(2001 EDITION)

品名 COMMODITY : SEAMLESS STEEL PIPE

寸法 SIZE : 406.4 X 13.0 X 9865
員数 QUANTITY : 1
質量 MASS : 1,400 kg
延べ長さ TOTAL LENGTH :

化学成分 CHEMICAL COMPOSITION (%)

製造番号 MFG.No	製鋼番号 HEAT No		C	Si	Mn	P	S	Cu	Ni	Cr	Mo	Al	Ti	V	Nb	B	N			Ceq		
			×1000	×100		×1000		×100				×1000				×10000				×100		
		max. H	80	100	200	45	30		1100	2000												
		min. H							800	1800												
		max. P																				
		min. P																				
55889-01 (1)	1-39071	H	50	42	148	33	2		909	1815												

外観・寸法検査 VISUAL&DIMENSION	GOOD	へん平試験 FLATTENING TEST	GOOD
水圧試験 HYDROSTATIC TEST	1000PSI GOOD	曲げ試験 BEND TEST	
ドリフト試験 DRIFT TEST		押しひろげ試験 FLARING TEST	
非破壊検査 N.D.E.	UT:GOOD		

〔注記〕Notes
H:溶鋼分析 HEAT ANALYSIS P:製品分析 PRODUCT ANALYSIS

引張試験 TENSILE TEST / 衝撃試験 IMPACT TEST / 硬さ試験 HARDNESS TEST

母材部 PARENT (SA370) 溶接部 WELD ( )
方向DIRECTION (L) GL (2")

製造番号 MFG.No	製鋼番号 HEAT No	降伏点or耐力 Y.P.orY.S. KSI	引張強さ T.S. KSI	伸び EL. %	降伏比 Y.R.	引張強さT.S. 溶接部WELD	方向DIRECTION ( ) 衝撃値or吸収エネルギー I.V.orA.E. EACH	衝撃値or吸収エネルギー I.V.orA.E. AVE.	延性破面率 SHEAR AREA(%) EACH	延性破面率 SHEAR AREA(%) AVE.	SPEC.
		max.									max.
		min. 300	750	35			min.				min.
55889-01 (1)	1-39071	310	819	68	*						

引張試験片 TENSILE SPECIMEN : 弧状or板状(STRIP) ASME1-1/2" / 丸棒(ROUND) / 管状(FULL SEC.)

〔備考〕REMARKS
ASME CODE SECTION II SA-312 TP304
2001 EDITION INCLUDING 2001 ADDENDA
WE CERTIFY THAT ALL REQUIREMENTS OF
ASME SPECIFICATION SA-312 TP304 AND
CUSTOMER SPEC. (ED-210-28) HAVE BEEN MET.
Y:NOT SOLUTION TREATED
W.Q:WATER QUENCHING
HEAT TREATMENT CONDITION
FOR TEST SPECIMEN
SOLUTION TREATED : 1060℃ X 47MM W.Q
FLATTENING TEST
1ST STEP : GOOD 2ND STEP : H=NO CRACK

I confirmed the spec. satisfies 2001 Edition 2002 Addenda 2002.12.25

12/27/02

Acc. Body ASME NACE

上記注文品は御指定の規格または仕様に従って製造され、その要求事項を満足していることを証明します。
WE HEREBY CERTIFY THAT THE MATERIALS DESCRIBED HEREIN HAVE BEEN MANUFACTURED, INSPECTED AND TESTED IN ACCORDANCE WITH THE CUSTOMER'S SPECIFICATION(S), AND THAT THEY SATISFY THE REQUIREMENTS.

板谷元晶
品質保証室長 CHIEF INSPECTOR

MISUZU

INSPECTION REPORT

CUSTOMER : ELLIOTT EBARA TURBO MACHINERY CORPORATION	EBARA SER. NO. : R021570804
ARTICLE : LUBE OIL CONSOLE UNIT	ITEM NO. : CT-9901/TC-9901
ITEM : PIPING	SERIAL NO. : U-2549
DRAWING NO. : ER021570804/902 (K1-01692)	INSPECTION DATE : 30th OCT. 2003

CUSTOMER : LG ENGINEERING & CONSTRUCTION CORP.

FINAL USER : TURKISH PETROLEUM REFINERIES CORP.

PROJECT : TUPRAS IZMIR REFINERY DHP PROJECT

JOB. NO. : 7020

SERVICE : RECYCLE GAS COMPRESSOR

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed

EETC Q.C Dept.

Certified by :

Inspected by : H. Tanaka

MISUZU Industrial Corporation

MISUZU

INSPECTION REPORT

CUSTOMER :
ELLIOTT-EBARA TURBOMACHINERY CORPORATION

EBARA SER. NO. :
R0215708

ARTICLE :
LUBE OIL CONSOLE UNIT

ITEM NO. :
CT-9901/TC-9901

PARTS NAME :
OIL PIPING

SERIAL NO. :
U-2549

INSPECTION ITEM :
MATERIAL IDENTIFICATION LIST

INSPECTION DATE :
30th OCT. 2003

NAME	MATERIAL	SIZE	HEAT No.
PIPE	A312TP304-S	3" × SCH40	V21431
		2" × SCH40	V20594
		1 1/2" × SCH40	V20614
		1" × SCH80	V20088
		3/4" × SCH80	V20522
		1/2" × SCH80	V20511
	A53 GR.B	3" × SCH40	12180
		2" × SCH80	E84219
		3/4" × SCH80	2-45418
		1/2" × SCH80	36589

Certified by : H. Tanaka

Inspected by :

MISUZU Industrial Corporation

CUSTOMER:

SUPPLIER: MAKII STAINLESS
KIND OF MATERIAL :
SEAMLESS STAINLESS STEEL PIPE

ASTM A312-00B TP304

U-25496

CONTRACT NO.: S50121508

MILL CERTIFICATE

KOBE SPECIAL TUBE CO.,LTD.
CHOFU-KITA PLANT
13-1, CHOFU-MINATOMACHI, SHIMONOSEKI
YAMAGUCHI-PREF, JAPAN

DATE OF ISSUE : MAR. 31, 2003
CERTIFICATE NO. : 030331-0017-01/01
ORDER NO. :

SUPPLIER CODE : 092
SECTION CODE : ADA
REFERENCE NO. : 3AR3289

SIZE : 88.9X5.5X5500

BUNDLE NO. : BMT-01 - BMT-05

Mfg. No. Product No.	Lot No.	Heat No.	Quantity No. of Pieces	Mass	Total Lengths	Tension Test *1	*2	0.2% Y.S.	T.S.	E.	Hardness Test		Grain Size
Unit Designated			PCS	kg				KSI		%	Method:		*3
Specification	Min.							30	75	35			
	Max.												
S07572	001	V21431	22	1379		S	2"	44	93	55			
	002	V21431	8	502		S	2"	43	92	55			
		TOTAL	30	1881									

Flattening Test	GOOD	Eddy Current Test	
Flaring Test		Ultrasonic Test	
Measurement & Surface	GOOD	Penetrant Test	
Corrosion Test			
Microscopic Test			
Hydrostatic Test	1900 PSI	GOOD	

Notes
* 1 : Type of Test piece
Full Section →(F)
Strip Section →(S)

* 2 : Gauge Length
50mm→(50), 2" →(2")
5.65√S →(S)

* 3 : Austenite Grain Size →(A)
Ferrite Grain Size →(F)

* 4 : Heat Analysis →(L)
Product Analysis →(C)

The product is able to be identified with Mfg.No. (Product No.-Lot No.), written in this certificate.

SOLUTION HEAT TREATMENT :2012°F X 5.0 MIN. / W.Q.
WIDTH OF GAGE LENGTH : 1"

Chemical Composition (%)

Heat No.	C ×100	Si ×100	Mn ×100	P ×1000	S ×1000	Ni ×100	Cr ×100	Mo ×100	*4
Specification Min.						800	1800		
Specification Max.	8	100	200	45	30	1100	2000		
V21431	5	39	180	29	5	843	1852		L

Remarks

SURVEYOR TO

IT IS HEREWITH CERTIFIED THAT THE ABOVE MATERIALS ARE SATISFACTORY IN COMPLIANCE WITH THE REQUIREMENTS SPECIFIED IN THE CONTRACT.

M. Nagai

MANAGER OF QUALITY SYSTEM SECTION.

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CUSTOMER:

SUPPLIER : MAKII STAINLESS
KIND OF MATERIAL :
SEAMLESS STAINLESS STEEL PIPE

ASTM A312-99 TP304

U-25496
CONTRACT NO.: S50720807

MILL CERTIFICATE

KOBE SPECIAL TUBE CO.,LTD.
CHOFU-KITA PLANT
13-1, CHOFU-MINATOMACHI, SHIMONOSEKI
YAMAGUCHI-PREF, JAPAN

DATE OF ISSUE : SEPT. 24, 2002
CERTIFICATE NO. : 020924-0010-01/01
ORDER NO. :

SUPPLIER CODE : 092
SECTION CODE : ADA
REFERENCE NO. : 2AM4587

SIZE : 60.3X3.9X4000

BUNDLE NO. : SLD-01 - SLD-04

Mfg. No. Product No.	Lot No.	Heat No.	Quantity No. of Pieces	Mass	Total Lengths	Tension Test *1	*2	0.2% Y.S.	T.S.	E.	Hardness Test		Grain Size
Unit Designated			PCS	kg				KSI		%	Method:		*3
Specification	Min.							30	75	35			
	Max.												
S97809	001	V20594	43	942		S	2"	40	91	58			
	002	V20588	8	175		S	2"	41	91	56			
		TOTAL	51	1117									

Flattening Test	GOOD	Eddy Current Test	
Flaring Test		Ultrasonic Test	
Measurement & Surface	GOOD	Penetrant Test	
Corrosion Test			
Microscopic Test			
Hydrostatic Test	1900 PSI	GOOD	

Notes
* 1 : Type of Test piece
Full Section →(F)
Strip Section →(S)
* 2 : Gauge Length
50mm→(50), 2" →(2")
5.65√S→(S)
* 3 : Austenite Grain Size →(A)
Ferrite Grain Size →(F)
* 4 : Heat Analysis →(L)
Product Analysis →(C)

The product is able to be identified with Mfg. No. (Product No.-Lot No.), written in this certificate.

SOLUTION HEAT TREATMENT :2012°F X 4.7 MIN. / W.Q.
WIDTH OF GAGE LENGTH : 1"

Chemical Composition (%)

Heat No.	C ×100	Si ×100	Mn ×100	P ×1000	S ×1000	Ni ×100	Cr ×100	Mo ×100	*4
Specification Min.						800	1800		
Specification Max.	8	75	200	40	30	1100	2000		
V20594	5	34	183	28	8	842	1841		L
V20588	5	43	181	28	9	850	1857		L

Remarks

SURVEYOR TO

IT IS HEREWITH CERTIFIED THAT THE ABOVE MATERIALS ARE SATISFACTORY IN COMPLIANCE WITH THE REQUIREMENTS SPECIFIED IN THE CONTRACT.

M. Nagai

MANAGER OF QUALITY SYSTEM SECTION.

MILL CERTIFICATE

KOBE SPECIAL TUBE CO.,LTD.

13-1, CHOFU-MINATOMACHI, SHIMONOSEKI
YAMAGUCHI-PREF. JAPAN

CUSTOMER:

SUPPLIER: MAKII STAINLESS

KIND OF MATERIAL: SEAMLESS STAINLESS STEEL PIPE

ASTM A312-00 TP304

U-25496

CONTRACT NO.: S50921105

SIZE: 48.30 X 3.68 X 4000

DATE OF ISSUE : JUL. 01, 2003
CERTIFICATE NO. : 021102-M323-01/01
ORDER NO.

SUPPLIER CODE : 092
SECTION CODE : ADA
REFERENCE NO. : 2AN4B31
02-6-9-2

BUNDLE NO. : X3F-01 - X3F-08

Mfg. No. Product No.	Lot No.	Heat No.	Quantity No. of Pcs (PCS)	Mass (kg)	Total Lengths	*1	*2	Tension Test 0.2% Y.S. (KSI)	T.S. (KSI)	E (%)	Hardness Test (Method:)	Grain Size (*3)
Specification Min.								30	75	35		
Specification Max.												
S06404	001	V20614	84	1395		F	2"	44	93	64		
	002	V20614	81	1343		F	2"	40	91	69		
	003	V20614	6	100		F	2"	43	91	67		
	004	V20614	6	100		F	2"	41	90	69		
	005	V20583	32	531		F	2"	41	92	67		
	090	TB8639	1	17		F	2"	42	91	66		
		TOTAL	210	3486								

Test	Result	Test	Result
Flattening Test	GOOD	Eddy Current Test	
Flaring Test		Ultrasonic Test	
Measurement & Surface	GOOD	Penetrant Test	
Corrosion Test			
Microscopic Test			
Hydrostatic Test	2300 PSI		GOOD

Notes
* 1. Type of Test piece: Full Section → (F) ; Strip Section → (S)
* 2. Gauge Length: 50mm → (56), 5.65√So → (S)
* 3. Austenite Grain Size → (A) ; Ferrite Grain Size → (F)
* 4. Heat Analysis → (L) ; Product Analysis → (P)

The product is also to be identified with this (Product No. Lot No.) written in this certificate.

SOLUTION HEAT TREATMENT :2012°F X 4.5 MIN. / W.Q.

Chemical Composition (%)

Heat No.	C ×100	Si ×100	Mn ×100	P ×1000	S ×1000	Ni ×100	Cr ×100	Mo ×100	*4
Specification Min.						800	1800		
Specification Max.	8	75	200	40	30	1100	2000		
V20614	5	55	181	28	2	893	1835		L
V20583	5	44	181	28	3	840	1838		L
TB8639	5	44	174	35	3	842	1825		L

Remarks

SERVICED TO

IT IS HEREWITH CERTIFIED THAT THE ABOVE MATERIALS ARE SATISFACTORY IN COMPLIANCE WITH THE REQUIREMENTS SPECIFIED IN THE CONTRACT.

M. Nagai

MANAGER OF QUALITY SYSTEM SECTION,
TECHNOLOGY DEPARTMENT.

CUSTOMER:

SUPPLIER : MAKII STAINLESS
KIND OF MATERIAL :
SEAMLESS STAINLESS STEEL PIPE

ASTM A312-00 TP304/304L& ORDER SPEC.

V-2549G ; 2581G

CONTRACT NO.: S50420801

MILL CERTIFICATE

KOBE SPECIAL TUBE CO.,LTD.
CHOFU-KITA PLANT
13-1,CHOFU-MINATOMACHI,SHIMONOSEKI
YAMAGUCHI PREF.JAPAN

DATE OF ISSUE : MAY 09, 2002
CERTIFICATE NO. : 020509-0005-01/01
ORDER NO. :

SUPPLIER CODE : 092
SECTION CODE : ADA
REFERENCE NO. : 2004519

SIZE : 33.4X4.55X6000

BUNDLE NO. : NO1-01 - NO1-04

Mfg. No. Product No.	Lot No.	Heat No.	Quantity No. of Pieces	Mass	Total Lengths	Tension Test *1	*2	0.2% Y.S.	T.S.	E.	Hardness Test		Grain Size
Unit Designated			PCS	kg				KSI		%	Method:		*3
Specification		Min.						30	75	35			
		Max.											
S86765	001	V20088	67	1313		F	2"	39	84	66			
	002	V20088	34	666		F	2"	41	86	64			
		TOTAL	101	1979									

Flattening Test	GOOD	Eddy Current Test	
Flaring Test		Ultrasonic Test	
Measurement & Surface	GOOD	Penetrant Test	
Corrosion Test			
Microscopic Test			
Hydrostatic Test	2500 PSI	GOOD	

Notes
* 1 : Type of Test piece
Full Section →(F)
Strip Section →(S)
* 2 : Gauge Length
50mm→(50), 2" →(2")
5.65√S →(S)
* 3 : Austenite Grain Size →(A)
Ferrite Grain Size →(F)
* 4 : Heat Analysis →(L)
Product Analysis →(C)

The product is able to be identified with Mfg.No. (Product No.-Lot No.) written in this certificate.

SOLUTION HEAT TREATMENT :2012°F X 5.0 MIN. / W.Q.

Chemical Composition (%)

Heat No.	C ×100	Si ×100	Mn ×100	P ×1000	S ×1000	Ni ×100	Cr ×100	Mo ×100	*4
Specification Min.						800	1800		
Specification Max.	3.5	75	200	40	30	1100	2000		
V20088	1.9	31	181	31	8	913	1835		L

Remarks

SURVEYOR TO

IT IS HEREWITH CERTIFIED THAT THE ABOVE MATERIALS ARE SATISFACTORY IN COMPLIANCE WITH THE REQUIREMENTS SPECIFIED IN THE CONTRACT.

K. Wada
MANAGER OF QUALITY SYSTEM SECTION.

72

CUSTOMER:

SUPPLIER : MAKII STAINLESS
KIND OF MATERIAL :
SEAMLESS STAINLESS STEEL PIPE
ASTM A312 TP304/304L & ORDER SPEC.

U-2549G : 2581G

CONTRACT NO.: S50852202

MILL CERTIFICATE

KOBE SPECIAL TUBE CO.,LTD.
CHOFU-KITA PLANT
13-1, CHOFU-MINATOMACHI, SHIMONOSEKI
YAMAGUCHI-PREF. JAPAN

DATE OF ISSUE : JULY 29, 2002
CERTIFICATE NO. : 020729-U003-01/01
ORDER NO. :

SUPPLIER CODE : 092
SECTION CODE : ADA
REFERENCE NO. : 2AM4573

SIZE : 26.67X3.91X6000

BUNDLE NO. : RWW-01 - RWW-02

Mfg. No. Product No.	Mfg. No. Lot No.	Heat No.	Quantity No. of Pieces	Quantity Mass	Quantity Total Lengths	Tension Test *1	Tension Test *2	Tension Test 0.2% Y.S.	Tension Test T.S.	Tension Test E.	Hardness Test		Grain Size
Unit Designated			PCS	kg				KSI		%	Method:		*3
Specification	Min.							30	75	35			
	Max.												
S97567	001	V20522	52	692		F	2"	43	86	62			

Flattening Test	GOOD	Eddy Current Test	
Flaring Test		Ultrasonic Test	
Measurement & Surface	GOOD	Penetrant Test	
Corrosion Test			
Microscopic Test			
Hydrostatic Test	2500 PSI	GOOD	

Notes
* 1 : Type of Test piece
Full Section →[F]
Strip Section →[S]
* 2 : Gauge Length
50mm→(50), 2" →2"
5.65√S →[S]
* 3 : Austenite Grain Size →[A]
Ferrite Grain Size →[F]
* 4 : Heat Analysis →[L]
Product Analysis →[C]
The product is able to be identified with Mfg. No. (Product No.-Lot No.) written in this certificate.

SOLUTION HEAT TREATMENT :2012°F X 4.7 MIN. / W.Q.

Chemical Composition (%)

Heat No.	C ×100	Si ×100	Mn ×100	P ×1000	S ×1000	Ni ×100	Cr ×100	Mo ×100							*4
Specification Min.						800	1800								
Specification Max.	3.5	75	200	40	30	1100	2000								
V20522	2.0	35	180	30	4	919	1840								L

Remarks

SURVEYOR TO

IT IS HEREWITH CERTIFIED THAT THE ABOVE MATERIALS ARE SATISFACTORY IN COMPLIANCE WITH THE REQUIREMENTS SPECIFIED IN THE CONTRACT.

M. Nagai

MANAGER OF QUALITY SYSTEM SECTION.

CUSTOMER:

SUPPLIER: MAKII STAINLESS

KIND OF MATERIAL :
SEAMLESS STAINLESS STEEL PIPE

ASTM A312 TP304/304L & ORDER SPEC.

MILL CERTIFICATE

KOBE SPECIAL TUBE CO.,LTD.

CHOFU-KITA PLANT

13-1, CHOFU-MINATOMACHI, SHIMONOSEKI
YAMAGUCHI PREF. JAPAN

DATE OF ISSUE : JULY 29, 2002
CERTIFICATE NO. : 020729-U002-01/01
ORDER NO. :

SUPPLIER CODE : 092
SECTION CODE : ADA
REFERENCE NO. : 2M4573

U-2549G, 2581G

CONTRACT NO.: S50652201

SIZE : 21.34X3.73X6000

BUNDLE NO. : RWT-01 - RWT-02

Mfg. No. Product No.	Lot No.	Heat No.	Quantity No. of Pieces	Mass	Total Lengths	Tension Test *1	*2	0.2% Y.S.	T.S.	E.	Hardness Test		Grain Size
Unit Designated			PCS	kg				KSI		%	Method:		*3
Specification Min.								30	75	35			
Specification Max.													
S97566	001	V20511	52	512		F	2"	40	85	64			

Flattening Test	GOOD	Eddy Current Test	
Flaring Test		Ultrasonic Test	
Measurement & Surface	GOOD	Penetrant Test	
Corrosion Test			
Microscopic Test			
Hydrostatic Test	2500 PSI		GOOD

Notes
* 1 : Type of Test piece
Full Section →(F)
Strip Section →(S)
* 2 : Gauge Length
50mm→(50), 2" →(2")
5.65√S →(S)
* 3 : Austenite Grain Size →(A)
Ferrite Grain Size →(F)
* 4 : Heat Analysis →(L)
Product Analysis →(C)

The product is able to be identified with Mfg. No. (Product No.-Lot No.), written in this certificate.

SOLUTION HEAT TREATMENT :2012°F X 4.5 MIN. / W.Q.

Chemical Composition (%)

Heat No.	C ×100	Si ×100	Mn ×100	P ×1000	S ×1000	Ni ×100	Cr ×100	Mo ×100							*4
Specification Min.						800	1800								
Specification Max.	3.5	75	200	40	30	1100	2000								
V20511	2.1	39	181	29	4	920	1855								L

Remarks

SURVEYOR TO

IT IS HEREWITH CERTIFIED THAT THE ABOVE MATERIALS ARE SATISFACTORY IN COMPLIANCE WITH THE REQUIREMENTS SPECIFIED IN THE CONTRACT.

M. Nagai

MANAGER OF QUALITY SYSTEM SECTION.

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検査証明書
INSPECTION CERTIFICATE

NKK 日本鋼管株式会社 NKK CORPORATION

本社 :〒100−8202東京都千代田区丸の内1丁目1番2号
Head Office:1-1-2, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8202 JAPAN

需要家 Purchaser	: SAKAE KOKAN CO., LTD.
需要家管理番号 Purchaser's Order No.	: 022043/U-2549G
注文者 Trading Co.	: NKK TRADING INC.
注文者照合番号 Reference No.	: 314 002016AA
品名 Commodity & 規格 Specification	: HOT FINISHED SEAMLESS STEEL PIPE API 5L B / ASTM A53 B BEVELED

証明書番号 Certificate No.	: A C5566-01 CONTINUED
日付 Date	: 1999-05-27
船番／工事番号 Ship's No. /Construction No.	:
製造番号 Production No.	: C5566
契約番号 Contract No.	: TM30442

寸法 Size: 3NDXSCH40X5500 N:INCH

行番 Item No.	長さ Length #1 (MM)		本数 Number of Pieces	延長さ Total Length #1 ( ) 質量 Mass	鋼番 Heat No.
003	5.500		161	9,998KGS	12180
		TOTAL	161	9,998KGS	

化学成分 Chemical Composition (%)

規格値 / 鋼番 Heat No.	#2	C ×100	Si ×100	Mn ×100	P ×1000	S ×1000	Cu ×100	Ni ×100	Cr ×100	Mo ×100		×1000	V ×100
Spec. 下限 Min.													
Spec. 上限 Max.	L	27		115	30	30	40	40	40	15			8
	P	27		115	30	30	40	40	40	15			8
12180	L	19	21	44	21	6	1	3	3	0			1
〃	P	20	21	45	19	5	1	3	3	0			1
〃	P	19	21	44	18	5	1	3	3	0			1

		※1 X100
SPEC. MAX.	L	100
MAX.	P	100
12180	L	8
〃	P	8

引張試験 Tensile Test

	#3	降伏点 耐力 YS #4	引張強さ T.S #4	伸び EL %	#5	硬度試験 Hardness Test ( )	
Spec. Min.	FS	241N	414N	29.5			
12180	FS	294N	458N	58.9			301103

外観・寸法 Visual & Dimension	水圧試験#6 (P) Hydrostatic Test	非破壊検査 N.D.I.	曲げ試験 Bending Test	へん平試験 Flattening Test	押しひろげ試験 Flaring Test	溶接部延性試験 Weld Ductility Test	塗覆装試験 Coating Test	メッキ試験 Galvanized Test
GOOD	GOOD 2500			GOOD				

※1=CU+MO+V+CR+NI

注記 Note

#1 MM:mm FN:ft-in
FI:ft

#2 L:溶鋼分析 Ladle Analysis
P:製品分析 Product Analysis

#3 試験片 Test Specimen
4L:JIS4号(縦) JIS№4
4T:JIS4号(横) JIS№4
5L:JIS5号(縦) JIS№5
5T:JIS5号(横) JIS№5
11:JIS11号 JIS№11
12:JIS12号(縦) JIS№12
RL:棒状試験片(縦) Round Specimen (Longitudinal)
RT:棒状試験片(横) Round Specimen (Transverse)
S1:帯状試験片(縦) Strip Specimen (Longitudinal) -width 1/2 in.
S2:帯状試験片(縦) Strip Specimen (Longitudinal) -width 3/4 in.
S3:帯状試験片(縦) Strip Specimen (Longitudinal) -width 1 1/2 in.
S4:帯状試験片(縦) Strip Specimen (Longitudinal) -width 1 in.
S5:帯状試験片(横) Strip Specimen (Transverse) -width 1 1/2 in.
SS:帯状試験片(縦) Strip Specimen (Longitudinal)
FS:管状試験片 Full Section
LW:溶接部縦方向 Longitudinal in weld
TW:溶接部横方向 Transverse in weld

#4 K :kgf/mm²
KS:ksi
MP:MPa
N :N/mm²

#5 YR:降伏比 Yield Ratio
RA:絞り Reduction of Area

#6 K :kgf/cm² P :psi KP:KPa MP:MPa N:N/mm² B:bar A:atm

上記製品は検査の結果指定の規格に合格していることを証明いたします。

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND ALSO WITH THE REQUIREMENTS CALLED FOR BY THE ABOVE ORDER.

京浜製鉄所：〒210−0855神奈川県川崎市川崎区南渡田町1番1号 KEIHIN WORKS: 1-1, MINAMIWATARIDA-CHO, KAWASAKI 210-0855 JAPAN

H. Furukawa

京浜製鉄所品質保証室長
Manager of Quality Assurance Sec.
KEIHIN WORKS

ŽELEZIARNE® PODBREZOVÁ

ISO 9002

Inspection certificate: 387949

022043/U-25496

Sheet No: 1
Order No.: 985326
Item No.: 07
Cust.Order No.: KQ05450X
Loading Bill No: 353948
Works No.: 38432501
Advice No.:
Wagon No.: GA 94 11, GA 71 47

Address: MARUBENI STEEL CORP.5TH FLOOR
4-6 HITOTSUBASHI C.BLDG,
00000 CHIYODA-KU TOKIO
JAPAN

Kind of material, Quantity	Material	Techn.requirements
SEAMLESS STEEL TUBES	GRADE B	ASTM A106/A106 M-97a
dimens. 60.30 X 5.54 X 6000+100 -0mm		API SP.5L-95
NB 2" SCH 80		
total length 516 m pieces 86 pc		ASTM A53/A53 M-97
total mase 3866 kg		
		EN 10204/3.1B

Results of tests

No.	Heat No.	Yield point MPa	Tens. strn. MPa	Elon gat. %	Hardness test HRB	Energy of impact J	Remarks
1	E 84219	333	463	28	-		

Flanging test	-	Hydrostatic test	17.2 Mpa satisfied
Ring drift test	-	Bend test	satisfied
Flattening test	-	Flaring test	-

Chemical composition [%] E - Melting process

Heat No.	C	Mn	Si	P	S	Cu	Cr	Ni	V	Nb	Ti
Min:	-	0.290	0.100	-	-	-	-	-	-	-	-
Max:	0.270	1.060	-	0.030	0.030	0.400	0.400	0.400	0.080	-	-
E 84219	0.140	0.490	0.250	0.007	0.015	0.210	0.090	0.070	0.002	0.001	0.001

	Mo
Min:	-
Max:	0.150
84219	0.010

Visual inspection and dimensional check without objections.
The tubes conform to the above mentioned standards.

Engineering inspection official Ing.Miroslav Vojtas.

1 Podbrezova : 27.10.98

ŽELEZIARNE PODBREZOVÁ akciová spoločnosť 976 81 Podbrezová
kontrolné a skúšobné oddelenie -3-

鋼管検査証明書
INSPECTION CERTIFICATE

証明書番号（送状番号）
CERTIFICATE NO. (INVOICE NO.): NL0230 (45-5879)

需要家発注NO.
ORDER NO. : 63608-04,08-030

契約番号
CONTRACT NO.: 2295-63608-04 (BG1 1)

注文者
SHIPPER : カワテツ ショウジ"

納入仕様書番号
M.P.S NO. : N960

需要家
CUSTOMER : サカエコウカン 022043/U-2549G

品名
COMMODITY SEAMLESS STEEL PIPE

規格
SPECIFICATION : API5LB/ASTMA53B

日付
DATE : 1998-12- 2

寸法
SIZE : NB3/4" X SCH80 X 6000

員数
QUANTITY : 235

質量
MASS : 3,102 Kg

延べ長さ
TOTAL LENGTH :

製造番号 MFG.NO.	製鋼番号 HEAT NO.		化学成分 CHEMICAL COMPOSITION (%) C ×100	Si ×100	Mn ×100	P ×1000	S ×1000	Cu ×100	Ni ×100	Cr ×100	Mo ×100	Al ×1000	Ti ×1000	V ×1000	Nb ×1000	N ×10000	Ceq. ×100	RES X100	引張試験 TENSILE TEST 降伏点又は耐力 Y.P or Y.S KSI	引張強さ T.S	引張強さ(溶接部) T.S (IN WELD)	伸び E.L (%)	降伏比 Y.R	衝撃試験 IMPACT TEST 吸収エネルギー IMPACT VALUE 採取方向 DIRECTION	延性破面率(%) SHEAR FRACTURE AREA	硬さ試験 HARDNESS TEST
		max.	27		115	30	30	40	40	40	15			80				100								SPEC.
		H min.																								max.
		max. P min.																								min.
		max.																								
		min.																	350	600		265		EACH	AVE.	EACH. AVE.
N3056-01 (166)	2-45418	H	21	20	55	19	7	<1	1	3	<1			2				4	493	719		482				
N3056-02 (69)	2-45419	H	22	20	50	17	7	<1	1	3	<1			2				4	541	739		484				

外観・寸法検査 VISUAL&DIMENSION	水圧試験 HYDROSTATIC TEST	へん平試験 FLATTENING TEST	曲げ試験 BEND TEST	押しひろげ試験 FLARING TEST	つば出し試験 FLANGE TEST	縦圧試験 CRUSH TEST	屈開試験 REVERSE FLATTENING TEST	めっき試験 GALVANIZED TEST	溶接部延性試験 WELD DUCTILITY TEST	ドリフト試験 DRIFT TEST	非破壊検査 N. D. E.	塗覆装試験 COATING TEST
GOOD	850PSI GOOD		GOOD								ET:GOOD	

NAZOTE 5J05

備考 REMARKS RES=CU+NI+CR+MO+V

注記 Notes
H…Heat analysis とりべ分析
P…Product analysis 製品分析
L…Longitudinal 縦方向
T…Transverse 横方向
Ceq…Carbon equivalent 炭素当量
A……G.L=5.65 $\sqrt{A}$

上記注文品は御指定の規格または仕様に従って製造され、その要求事項を満足していることを証明します。
WE HEREBY CERTIFY THAT THE MATERIALS DESCRIBED HEREIN HAVE BEEN MANUFACTURED, INSPECTED AND TESTED IN ACCORDANCE WITH THE CUSTOMER'S SPECIFICATION(S), AND THAT THEY SATISFY THE REQUIREMENTS.

川崎製鉄株式会社
KAWASAKI STEEL CORPORATION
知多製造所
CHITA WORKS
愛知県半田市川崎町1丁目1番地 〒475-8611
1, Kawasaki-cho 1-chome, Handa-City, Aichi Pref. 475-8611 Japan

田上俊久
CHIEF INSPECTOR

JP02

検査証明書
INSPECTION CERTIFICATE

NKK 日本鋼管株式会社 NKK CORPORATION

本社：〒100東京都千代田区丸の内1丁目1番2号
Head Office:1-1-2, MARUNOUCHI, CHIYODA-KU, TOKYO 100 JAPAN

需要家 Purchaser	: SAKAE KOKAN CO., LTD.
需要家管理番号 Purchaser's Order No.	: 0ZZ043/U-25496
注文者 Trading Co.	: NKK TRADING INC.
注文者照合番号 Reference No.	: 312 002016AA
品名 & 規格 Commodity & Specification	: COLD FINISHED SEAMLESS STEEL PIPE API 5L B / ASTM A53 B PLAIN END

証明書番号 Certificate No.	: A 3M480
日付 Date	: 1997-11-20
船番／工事番号 Ship's No. / Construction No.	:
製造番号 Production No.	: 3M480
契約番号 Contract No.	: TM80587

寸法 Size: 1/2NDXSCH80X5500 N:INCH

行番 Item No.	長さ Length #1(MM)		本数 Number of Pieces	延長さ Total Length #1( ) 質量 Mass	鋼番 Heat No.
01i	5,500		368	3,279KGS	36589
		TOTAL	368	3,279KGS	

化学成分 Chemical Composition (%)

鋼番 Heat No.	#2	C ×100	Si ×100	Mn ×100	P ×1000	S ×1000	Cu ×100	Ni ×100	Cr ×100	Mo ×100	×1000	V ×100
規格値 下限 Spec. Min.												
規格値 上限 Spec. Max.	L	27		115	30	30	40	40	40	15		8
36589	L	19	23	42	11	4	4	3	3	0		0
〃	P	20	22	40	10	6	5	3	3	1		0
〃	P	19	23	43	15	4	4	2	4	1		1

		※1 ×100
SPEC. MAX.	L	100
36589	L	10
〃	P	12
〃	P	12

※1=CU+MO+V+CR+NI

引張試験 Tensile Test

	#3	降伏点 耐力 Y.S #4	引張強さ T.S #4	伸び EL % #5	硬度試験 Hardness Test
規格値 Spec. Min.	FS	241N	414N	25.0	
01i	FS	331N	466N	49.2	

802111

外観・寸法 Visual & Dimension	水圧試験#6(P) Hydrostatic Test	非破壊検査 N.D.E.	曲げ試験 Bending Test	へん平試験 Flattening Test	押しひろげ試験 Flaring Test	溶接部延性試験 Weld Ductility Test	塗覆装試験 Coating Test	メッキ試験 Galvanized Test
GOOD	GOOD 850		GOOD					

注記 Note

#1 MM:mm #N:ft-in FT:ft
#2 L:溶鋼分析 Ladle Analysis P:製品分析 Product Analysis
#3 試験片 Test Specimen
4L:JIS4号(縦) JIS Z2201 No.4
4T:JIS4号(横) JIS Z2201 No.4
5L:JIS5号(縦) JIS Z2201 No.5
5T:JIS5号(横) JIS Z2201 No.5
11:JIS11号 JIS Z2201 No.11
12:JIS12号(縦) JIS Z2201 No.12
FS:管状試験片 Full Section
LW:溶接部縦方向 Longitudinal in Weld
TW:溶接部横方向 Transverse in Weld
PL:丸棒試験片(縦) Round Specimen(Longitudinal)
RT:丸棒試験片(横) Round Specimen(Transverse)
S1:帯状試験片(縦) Strip Specimen(Longitudinal)-Width 1/2 in.
S2:帯状試験片(縦) Strip Specimen(Longitudinal)-Width 3/4 in.
S3:帯状試験片(縦) Strip Specimen(Longitudinal)-Width 1 1/2 in.
S4:帯状試験片(縦) Strip Specimen(Longitudinal)-Width 1 in.
S5:帯状試験片(横) Strip Specimen(Transverse) -Width 1 1/2 in.
S6:帯状試験片(縦) Strip Specimen(Longitudinal)
#4 K:kgf/mm² kS:ksi MP:MPa N:N/mm²
#5 YR:降伏比 Yield Ratio RA:絞り Reduction of Area
#6 K:kgf/cm² P:psi KP:KPa MP:MPa N:N/mm² B:bar A:atm

上記商品は検査の結果指定の規格に合格していることを証明いたします。

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND ALSO WITH THE REQUIREMENTS CALLED FOR BY THE ABOVE ORDER.

京浜製鉄所：〒210神奈川県川崎市川崎区南渡田町1番1号 KEIHIN WORKS: 1-1, MINAMIWATARIDA-CHO, KAWASAKI 210 JAPAN

京浜製鉄所品質保証室長
Manager of Quality Assurance Sec.
KEIHIN WORKS

放射線透過検査記録
RADIOGRAPHIC EXAMINATION RECORD

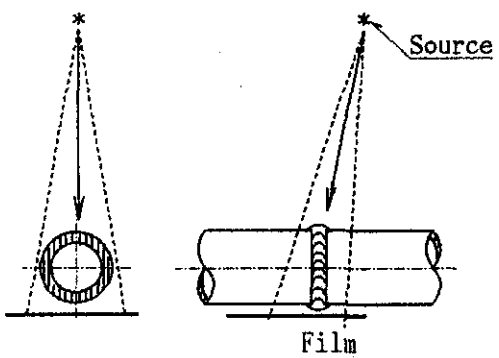
記録番号 RECORD NO.
08019165 (1/18)
発行年月日 DATE ISSUED
Oct., 3, 2003

注文主 OWNER/CUSTOMER MISUZU INDUSTRIAL CORPORATION	適用規格 APPLIED CODE/RULE ANSI B31.3 (2001 Edition) and thru,2003 Addenda
工事番号 WORK NO. U－2549	判定基準 ACCEPTANCE STANDARD ANSI B31.3 Para 341.3.2A
工事名称 WORK NAME LUBE OIL CONSOLE UNIT	材質 MATERIAL A312 TP304-TP, A53 GrB.
部品名称／部品番号 PARTS NAME/PARTS NO. PIPING	数量 QUANTITY 119 Joints / 検査工程 EXAMI. STAGE After Welding
図面番号 / DWG.NO. U-2549 (1)~(7),(9)~(12),(16),(23)~(26)	検査年月日 EXAMI.DATE/LOCATION Sept.,20,2003~Sept.29,2003 / IIC AIOI

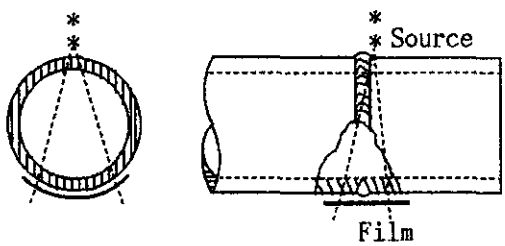
継手番号 JOINT NO. OR JOINT NAME	X-RAY γ-RAY 名称 APPARATUS NAME	撮影条件 焦点 FOCUS SIZE (mmxmm)	電圧 KVp 線源 SOURCE	電流 mA 線源強 GBq	時間 TIME (min)	距離 DISTANCE (mm)	フィルム FILM TYPE	増感紙 SCREEN	板厚(mm) TH'S (材厚)(mm) WELD TH'S	透過度計 PENETRAMETER	溶接方法 WELDING PROCESS
AS PER ATTACHED SHEETS	RF250EG-S2 (TX-40)	2.0 X 2.0	AS	FOLL	OW		FUJI #100	Pb F:0.13 B:0.2	AS FOLLOW	Hole Type No.15 No.12 No.12(F) Wire type A	—

階調計 CONTRAST METER —	有効長 EFFICIENT LENGTH AS FOLLOW	撮影率 EXAMI.PERCENT -	現像処理 FILM PROCESSING 自動現像機 24°C 11min. AUTOMATIC (No.FIP4000-1)
撮影要領図 SKETCH OF RADIOGRAPHED ARRANGEMENT		濃度計 DENSITOMETER PDA85-No.9	フィルム観察器 FILM ILLUMINATOR TS-No.12

単位 UNIT :mm



50A & 80A
(2 shot)



150A
(6 partition)

濃度 FILM DENSITY 1.8~4.0		DATE	承認 APPROVED BY T. Kawauchi Oct/3/03 DATE
枚数 NO. OF FILM 246 FILMS		DATE	審査 REVIEWED BY (LEVEL II) DATE Y. Nishiyama Oct./3/03
結果 JUDGEMENT RESULT ACCEPTABLE		DATE	検査 EXAMINED BY (LEVEL) DATE H. Haraoka Sep/29/03
	客先 検査官 CUSTOMER.INSPECTOR		相生事業所 検査実施部 SECTION PERFORMED

石川島検査計測株式会社
Ishikawajima-Inspection & Instrumentation Co.,Ltd.

MISUZU Industries Corporation
Nagatsuka

08019165 (2/8)

U-2549 LUBE OIL CONSOLE UNIT PIPING

撮影条件 / EXAMINED CONDITIONS

LINE No. JOINT No.	PIPE SIZE	EFFICIENT LENGTH	THICKNESS	Kvp	mA	TIME min.	DISTA-NCE	FILM TYPE	PENETRA METER
W1A	80Axt5.5	1/2 CIRCUM	7.0	190	5.0	1.0	750	#100	No.15
W1									
W2									
W3A									
W3									
W4	80Axt5.5		7.0	190					No.15
W5	50Axt3.9		5.4	160					No.12
W6									
W7									
W8									
W9									
W10									
W11									
W12									
W13									
W14									
W15									
W16									
W17									
W18									
W19									
W20									
W21									
W22									
W23									
W24	50Axt3.9		5.4	160					No.12
W25	80Axt5.5		7.0	190					No.15
W26	80Axt5.5		7.0	190					No.15
W27	50Axt3.9		5.4	160					No.12
W28	50Axt3.9	1/2 CIRCUM	5.4	160	5.0	1.0	750	#100	No.12

※ W1A~W28:A312 TP304-S

08019165 (3/18)

U-2549 LUBE OIL CONSOLE UNIT PIPING

撮影条件 / EXAMINED CONDITIONS

LINE No. JOINT No.	PIPE SIZE	EFFICIENT LENGTH	THICKNESS	Kvp	mA	TIME min.	DISTA -NCE	FILM TYPE	PENETRA METER
W29	50Axt3.9	1/2 CIRCUM	5.4	160	5.0	1.0	750	#100	No.12
W30	〃	〃	〃	〃	〃	〃	〃	〃	〃
W31	〃	〃	〃	〃	〃	〃	〃	〃	〃
W32	〃	〃	〃	〃	〃	〃	〃	〃	〃
W33	〃	〃	〃	〃	〃	〃	〃	〃	〃
W34	〃	〃	〃	〃	〃	〃	〃	〃	〃
W35	〃	〃	〃	〃	〃	〃	〃	〃	〃
W36	〃	〃	〃	〃	〃	〃	〃	〃	〃
W37	〃	〃	〃	〃	〃	〃	〃	〃	〃
W38	〃	〃	〃	〃	〃	〃	〃	〃	〃
W39	〃	〃	〃	〃	〃	〃	〃	〃	〃
W40	〃	〃	〃	〃	〃	〃	〃	〃	〃
W41	〃	〃	〃	〃	〃	〃	〃	〃	〃
W42	〃	〃	〃	〃	〃	〃	〃	〃	〃
W43	〃	〃	〃	〃	〃	〃	〃	〃	〃
W44	〃	〃	〃	〃	〃	〃	〃	〃	〃
W45	〃	〃	〃	〃	〃	〃	〃	〃	〃
W46	〃	〃	〃	〃	〃	〃	〃	〃	〃
W47	〃	〃	〃	〃	〃	〃	〃	〃	〃
W48	〃	〃	〃	〃	〃	〃	〃	〃	〃
W49	〃	〃	〃	〃	〃	〃	〃	〃	〃
W50	〃	〃	〃	〃	〃	〃	〃	〃	〃
W51	〃	〃	〃	〃	〃	〃	〃	〃	〃
W52	〃	〃	〃	〃	〃	〃	〃	〃	〃
W53	〃	〃	〃	〃	〃	〃	〃	〃	〃
W54	〃	〃	〃	〃	〃	〃	〃	〃	〃
W55	〃	〃	〃	〃	〃	〃	〃	〃	〃
W56	〃	〃	〃	〃	〃	〃	〃	〃	〃
W57	〃	〃	〃	〃	〃	〃	〃	〃	〃
W58	50Axt3.9	1/2 CIRCUM	5.4	160	5.0	1.0	750	#100	No.12

※ W29~W58:A312 TP304-S

MITSUBISHI Heavy Industries, Ltd.

U-2549 LUBE OIL CONSOLE UNIT PIPING

撮影条件 / EXAMINED CONDITIONS

LINE No. JOINT No.	PIPE SIZE	EFFICIENT LENGTH	THICKNESS	Kvp	mA	TIME min.	DISTANCE	FILM TYPE	PENETRAMETER
W59	50AXt3.9	1/2 CIRCUM	5.4	160	5.0	1.0	750	#100	No.12
W60	↑	↑	↑	↑	↑	↑	↑	↑	↑
W61									
W62									
W63									
W64									
W65									
W66									
W67									
W68									
W69									
W70									
W71									
W72									
W73									
W74									
W75									
W76									
W77	↓	↓	↓	↓					↓
W78	50AXt3.9	↓	5.4	160			↓		No.12
W79	80AXt5.5	1/2 CIRCUM	7.0	190			750		No.15
W80	150AXt7.1	88mm	8.6	180			450		No.12(F)
W81	150AXt7.1	88mm	8.6	180			450		No.12(F)
W82	80AXt5.5	1/2 CIRCUM	7.0	190			750		No.15
W83	50AXt3.9	↑	5.4	160			↑		No.12
W84	↑	↑	↑	↑			↑		↑
W85									
W86									
W87	↓	↓	↓	↓	↓	↓	↓	↓	↓
W88	50AXt3.9	1/2 CIRCUM	5.4	160	5.0	1.0	750	#100	No.12

※ W59~W88:A312 TP304-S

U-2549 LUBE OIL CONSOLE UNIT PIPING

撮影条件 / EXAMINED CONDITIONS

LINE No. JOINT No.	PIPE SIZE	EFFICIENT LENGTH	THICKNESS	Kvp	mA	TIME min.	DISTANCE	FILM TYPE	PENETRAMETER
W89	50Axt3.9	1/2 CIRCUM	5.4	160	5.0	1.0	750	#100	No.12
W90	↑	↑	↑	↑	↑	↑	↑	↑	↑
W91									
W92									
W93									
W94									
W95									
W96									
W97									
W98									
W99									
W100									
W101									
W102									
W103									
W104									
W105									
W106									
W107									
W108									
W109									
W110									
W111	↓		↓	↓					No.12
W112	50Axt3.9		5.4	160					A
W113	80Axt5.5		7.0	190					No15
W114	80Axt5.5		↑	↑					↑
W115	50Axt5.5								
W116	50Axt5.5	↓	↓	↓	↓	↓	↓	↓	↓
W117	80Axt5.5	1/2 CIRCUM	7.0	190	5.0	1.0	750	#100	No.15

※ W89~W112:A312 TP304-S, W113~W117:A53 Gr.B

Mitsubishi Heavy Industries, Ltd.

放射線透過検査記録
RADIOGRAPHIC EXAMINATION RECORD

記録番号 RECORD No. (6/18)

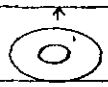
結果 RESULT / フィルム番号 FILM No.	濃度 DENSITY CHECK	無欠陥 NO APPARENT DEFECT	第一種 ROUNDED INDUCTION	第二種 ELONGATED SLAG	第三種 CRACK	第四種 TUNGSTEN INCL.	残在 EXISTING TOGETHER	溶込不良 INCOMPLETE PENETRATION	融合不良 LACK OF FUSION	判定結果 JUDGEMENT 社内検査 合格 ACCEPT-ABLE	社内検査 不合格 REJECT	客先検査官 CUSTOMER INSPECTOR OWNER SURVEYOR 合格 ACCEPT-ABLE	客先検査官 不合格 REJECT	備考（欠陥記録） REMARK (DESCRIPTION OF DEFECTS) 単位 UNIT : mm
W1A-A	✓	✓								✓				
B	✓	✓												
W1-A	✓	✓												
B	✓	✓												
W2-A	✓	✓												
B	✓	✓												
W3A-A	✓	✓												
B	✓	✓												
W3-A	✓	✓												
B	✓	✓												
W4-A	✓	✓												
B	✓	✓												
W5-A	✓	✓												
B	✓	✓												
W6-A	✓	✓												
B	✓	✓												
W7-A	✓	✓												
B	✓	✓												
W8-A	✓	✓												
B	✓					✓								TUNo.7φ

石川島検査計測株式会社

ISHIKAWAJIMA Industrial Corporation

放射線透過検査記録
RADIOGRAPHIC EXAMINATION RECORD

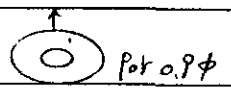
記録番号 RECORD No. 85 (7/18)

結果 RESULT / フィルム番号 FILM No.	濃度 DENSITY CHECK	無欠陥 NO APPARENT DEFECT	第一種 ROUNDED INDUCTION	第二種 ELONGATED SLAG	第三種 CRACK	第四種 TUNGSTEN INCL.	残在 EXISTING TOGETHER	溶込不良 INCOMPLETE PENETRATION	融合不良 LACK OF FUSION	判定結果 JUDGEMENT 社内検査 合格 ACCEPT-ABLE	社内検査 不合格 REJECT	客先検査官 CUSTOMER INSPECTOR OWNER SURVEYOR 合格 ACCEPT-ABLE	客先検査官 不合格 REJECT	備考（欠陥記録） REMARK (DESCRIPTION OF DEFECTS) 単位 UNIT : mm
W9-A	✓	✓								10.10				
B	✓	✓												
W10-A	✓	✓												
B	✓	✓												
W11-A	✓	✓												
B	✓	✓												
W12-A	✓	✓												
B	✓	✓												
W13-A	✓	✓												
B	✓	✓												
W14-A	✓	✓												
B	✓	✓												
W15-A	✓	✓												
B	✓	✓												
W16-A	✓					✓								 TUNo.64
B	✓	✓												
W17-A	✓	✓												
B	✓	✓												
W18-A	✓	✓												
B	✓	✓												

石川島検査計測株式会社

放射線透過検査記録
RADIOGRAPHIC EXAMINATION RECORD

記録番号 RECORD No. 86 (8/18)

結果 RESULT / フィルム番号 FILM No.	濃度 DENSITY CHECK	無欠陥 NO APPARENT DEFECT	第一種 ROUNDED INDUCTION	第二種 ELONGATED SLAG	第三種 CRACK	第四種 TUNGSTEN INCL.	残在 EXISTING TOGETHER	溶込不良 INCOMPLETE PENETRATION	融合不良 LACK OF FUSION	判定結果 JUDGEMENT 社内検査 合格 ACCEPT-ABLE	社内検査 不合格 REJECT	客先検査官 CUSTOMER INSPECTOR OWNER SURVEYOR 合格 ACCEPT-ABLE	客先検査官 不合格 REJECT	備考(欠陥記録) REMARK (DESCRIPTION OF DEFECTS) 単位 UNIT : mm
W19-A	✓	✓								A.A				
B	✓		✓											 Por 0.8φ
W20-A	✓	✓												
B	✓	✓												
W21-A	✓	✓												
B	✓	✓												
W22-A	✓	✓												
B	✓	✓												
W23-A	✓	✓												
B	✓	✓												
W24-A	✓	✓												
B	✓	✓												
W25-A	✓	✓												
B	✓	✓												
W26-A	✓	✓												
B	✓	✓												
W27-A	✓	✓												
B	✓	✓												
W28-A	✓	✓												
B	✓	✓												

石川島検査計測株式会社

放射線透過検査記録
RADIOGRAPHIC EXAMINATION RECORD

記録番号 RECORD No. (9/18)

結果 RESULT / フィルム番号 FILM No.	濃度 DENSITY CHECK	無欠陥 NO APPARENT DEFECT	第一種 ROUNDED INDUCTION	第二種 ELONGATED SLAG	第三種 CRACK	第四種 TUNGSTEN INCL.	既在 EXISTING TOGETHER	溶込不良 INCOMPLETE PENETRATION	融合不良 LACK OF FUSION	判定結果 JUDGEMENT 社内検査 合格 ACCEPTABLE	社内検査 不合格 REJECT	客先検査官 CUSTOMER INSPECTOR OWNER SURVEYOR 合格 ACCEPTABLE	客先検査官 不合格 REJECT	備考(欠陥記録) REMARK (DESCRIPTION OF DEFECTS) 単位 UNIT : mm
W29-A	✓	✓								14.19				
B	✓	✓												
W30-A	✓	✓												
B	✓	✓												
W31-A	✓	✓												
B	✓	✓												
W32-A	✓	✓												
B	✓	✓												
W33-A	✓	✓												
B	✓		✓											○ Por 0.9φ
W34-A	✓	✓												
B	✓	✓												
W35-A	✓	✓												
B	✓	✓												
W36-A	✓	✓												
B	✓	✓												
W37-A	✓	✓												
B	✓	✓												
W38-A	✓	✓												
B	✓	✓												

放射線透過検査記録
RADIOGRAPHIC EXAMINATION RECORD

記録番号 RECORD No. (10/18)

結果 RESULT / フィルム番号 FILM No.	濃度 DENSITY CHECK	無欠陥 NO APPARENT DEFECT	第一種 ROUNDED INDUCTION	第二種 ELONGATED SLAG	第三種 CRACK	第四種 TUNGSTEN INCL.	残在 EXISTING TOGETHER	溶込不良 INCOMPLETE PENETRATION	融合不良 LACK OF FUSION	判定結果 JUDGEMENT 社内検査 合格 ACCEPT-ABLE	社内検査 不合格 REJECT	客先検査官 CUSTOMER INSPECTOR OWNER SURVEYOR 合格 ACCEPT-ABLE	客先検査官 不合格 REJECT	備考（欠陥記録） REMARK (DESCRIPTION OF DEFECTS) 単位 UNIT : mm
W39-A	✓	✓								A. A				
B	✓	✓												
W40-A	✓	✓												
B	✓	✓												
W41-A	✓	✓												
B	✓	✓												
W42-A	✓	✓												
B	✓	✓												
W43-A	✓	✓												
B	✓	✓												
W44-A	✓	✓												
B	✓	✓												
W45-A	✓	✓												
B	✓	✓												
W46-A	✓	✓												
B	✓	✓												
W47-A	✓	✓												
B	✓	✓												
W48-A	✓	✓												
B	✓	✓												

石川島検査計測株式会社

放射線透過検査記録
RADIOGRAPHIC EXAMINATION RECORD

記録番号 RECORD No. (11/18)

結果 RESULT / フィルム番号 FILM No.	濃度 DENSITY CHECK	無欠陥 NO APPARENT DEFECT	第一種 ROUNDED INDUCTION	第二種 ELONGATED SLAG	第三種 CRACK	第四種 TUNGSTEN INCL.	屈在 EXISTING TOGETHER	溶込不良 INCOMPLETE PENETRATION	融合不良 LACK OF FUSION	判定結果 JUDGEMENT 社内検査 合格 ACCEPTABLE	社内検査 不合格 REJECT	客先検査官 CUSTOMER INSPECTOR OWNER SURVEYOR 合格 ACCEPTABLE	客先検査官 不合格 REJECT	備考(欠陥記録) REMARK (DESCRIPTION OF DEFECTS) 単位 UNIT : mm
W49-A	✓	✓								H.C				
B	✓	✓												
W50-A	✓	✓												
B	✓	✓												
W51-A	✓	✓												
B	✓	✓												
W52-A	✓	✓												
B	✓	✓												
W53-A	✓	✓												
B	✓	✓												
W54-A	✓	✓												
B	✓	✓												
W55-A	✓	✓												
B	✓	✓												
W56-A	✓	✓												
B	✓	✓												
W57-A	✓	✓												
B	✓	✓												
W58-A	✓	✓												
B	✓	✓												

放射線透過検査記録
RADIOGRAPHIC EXAMINATION RECORD

記録番号 RECORD No. 90 (12/18)

結果 RESULT / フィルム番号 FILM No.	濃度 DENSITY CHECK	無欠陥 NO APPARENT DEFECT	第一種 ROUNDED INDUCTION	第二種 ELONGATED SLAG	第三種 CRACK	第四種 TUNGSTEN INCL.	混在 EXISTING TOGETHER	溶込不良 INCOMPLETE PENETRATION	融合不良 LACK OF FUSION	判定結果 JUDGEMENT 社内検査 合格 ACCEPT-ABLE	社内検査 不合格 REJECT	客先検査官 CUSTOMER INSPECTOR OWNER SURVEYOR 合格 ACCEPT-ABLE	客先検査官 不合格 REJECT	備考(欠陥記録) REMARK (DESCRIPTION OF DEFECTS) 単位 UNIT : mm
W59-A	✓	✓								10.19				
B	✓	✓												
W60-A	✓		✓											○ PoV 0.8φ
B	✓	✓												
W61-A	✓	✓												
B	✓	✓												
W62-A	✓	✓												
B	✓	✓												
W63-A	✓	✓												
B	✓	✓												
W64-A	✓	✓												
B	✓	✓												
W65-A	✓	✓												
B	✓	✓												
W66-A	✓	✓												
B	✓	✓												
W67-A	✓	✓												
B	✓	✓												
W68-A	✓	✓												
B	✓	✓												

放射線透過検査記録
RADIOGRAPHIC EXAMINATION RECORD

記録番号 RECORD No. 91 (13/18)

結果 RESULT / フィルム番号 FILM No.	濃度 DENSITY CHECK	無欠陥 NO APPARENT DEFECT	第一種 ROUNDED INDUCTION	第二種 ELONGATED SLAG	第三種 CRACK	第四種 TUNGSTEN INCL.	屈在 EXISTING TOGETHER	溶込不良 INCOMPLETE PENETRATION	融合不良 LACK OF FUSION	判定結果 JUDGEMENT 社内検査 合格 ACCEPT-ABLE	社内検査 不合格 REJECT	客先検査官 CUSTOMER INSPECTOR OWNER SURVEYOR 合格 ACCEPT-ABLE	客先検査官 不合格 REJECT	備考（欠陥記録） REMARK (DESCRIPTION OF DEFECTS) 単位 UNIT : mm
W69-A	✓					✓				✓	✓			○ TuN 1.2φ
B	✓	✓												
W70-A	✓	✓												
B	✓	✓												
W71-A	✓	✓												
B	✓	✓												
W72-A	✓	✓												
B	✓	✓												
W73-A	✓	✓												
B	✓	✓												
W74-A	✓	✓												
B	✓	✓												
W75-A	✓	✓												
B	✓	✓												
W76-A	✓	✓												
B	✓	✓												
W77-A	✓	✓												
B	✓	✓												
W78-A	✓	✓												
B	✓	✓												

石川島検査計測株式会社

放射線透過検査記録
RADIOGRAPHIC EXAMINATION RECORD

記録番号 RECORD No. 92 (14/18)

結果 RESULT / フィルム番号 FILM No.	濃度 DENSITY CHECK	無欠陥 NO APPARENT DEFECT	第一種 ROUNDED INDUCTION	第二種 ELONGATED SLAG	第三種 CRACK	第四種 TUNGSTEN INCL.	混在 EXISTING TOGETHER	溶込不良 INCOMPLETE PENETRATION	融合不良 LACK OF FUSION	判定結果 JUDGEMENT 社内検査 合格 ACCEPT-ABLE	社内検査 不合格 REJECT	客先検査官 CUSTOMER INSPECTOR OWNER SURVEYOR 合格 ACCEPT-ABLE	客先検査官 不合格 REJECT	備考(欠陥記録) REMARK (DESCRIPTION OF DEFECTS) 単位 UNIT : mm
W79-A	✓	✓								H.H				
B	✓	✓												
W80-A	✓	✓												
B	✓	✓												
C	✓	✓												
D	✓	✓												
E	✓	✓												
F	✓	✓												
W81-A	✓	✓												
B	✓	✓												
C	✓	✓												
D	✓	✓												
E	✓	✓												
F	✓	✓												
W82-A	✓	✓												
B	✓	✓												
W83-A	✓	✓												
B	✓	✓												
W84-A	✓	✓												
B	✓	✓												

放射線透過検査記録
RADIOGRAPHIC EXAMINATION RECORD

記録番号 RECORD No. 93 (15/18)

結果 RESULT / フィルム番号 FILM No.	濃度 DENSITY CHECK	無欠陥 NO APPARENT DEFECT	第一種 ROUNDED INDUCTION	第二種 ELONGATED SLAG	第三種 CRACK	第四種 TUNGSTEN INCL.	屑在 EXISTING TOGETHER	溶込不良 INCOMPLETE PENETRATION	融合不良 LACK OF FUSION	判定結果 JUDGEMENT 社内検査 合格 ACCEPT-ABLE	社内検査 不合格 REJECT	客先検査官 CUSTOMER INSPECTOR OWNER SURVEYOR 合格 ACCEPT-ABLE	客先検査官 不合格 REJECT	備考（欠陥記録） REMARK (DESCRIPTION OF DEFECTS) 単位 UNIT : mm
W85-A	✓	✓								14.1d				
B	✓	✓												
W86-A	✓	✓												
B	✓	✓												
W87-A	✓	✓												
B	✓	✓												
W88-A	✓	✓												
B	✓	✓												
W89-A	✓	✓												
B	✓	✓												
W90-A	✓	✓												
B	✓	✓												
W91-A	✓	✓												
B	✓	✓												
W92-A	✓	✓												
B	✓	✓												
W93-A	✓	✓												
B	✓	✓												
W94-A	✓	✓												
B	✓	✓												

放射線透過検査記録
RADIOGRAPHIC EXAMINATION RECORD

記録番号 RECORD No. (16/18)

結果 RESULT / フィルム番号 FILM No.	濃度 DENSITY CHECK	無欠陥 NO APPARENT DEFECT	第一種 ROUNDED INDUCTION	第二種 ELONGATED SLAG	第三種 CRACK	第四種 TUNGSTEN INCL.	混在 EXISTING TOGETHER	溶込不良 INCOMPLETE PENETRATION	融合不良 LACK OF FUSION	判定結果 JUDGEMENT 社内検査 合格 ACCEPTABLE	社内検査 不合格 REJECT	客先検査官 CUSTOMER INSPECTOR OWNER SURVEYOR 合格 ACCEPTABLE	客先検査官 不合格 REJECT	備考（欠陥記録） REMARK (DESCRIPTION OF DEFECTS) 単位 UNIT : mm
W95-A	✓	✓								14 14				
B	✓	✓												
W96-A	✓	✓												
B	✓	✓												
W97-A	✓	✓												
B	✓	✓												
W98-A	✓	✓												
B	✓	✓												
W99-A	✓	✓												
B	✓	✓												
W100-A	✓	✓												
B	✓	✓												
W101-A	✓	✓												
B	✓	✓												
W102-A	✓	✓												
B	✓	✓												
W103-A	✓	✓												
B	✓	✓												
W104-A	✓	✓												
B	✓	✓												

放射線透過検査記録
RADIOGRAPHIC EXAMINATION RECORD

記録番号 RECORD No. 95 (17/18)

結果 RESULT / フィルム番号 FILM No.	濃度 DENSITY CHECK	無欠陥 NO APPARENT DEFECT	第一種 ROUNDED INDUCTION	第二種 ELONGATED SLAG	第三種 CRACK	第四種 TUNGSTEN INCL.	混在 EXISTING TOGETHER	溶込不良 INCOMPLETE PENETRATION	融合不良 LACK OF FUSION	判定結果 JUDGEMENT 社内検査 合格 ACCEPT-ABLE	社内検査 不合格 REJECT	客先検査官 CUSTOMER INSPECTOR OWNER SURVEYOR 合格 ACCEPT-ABLE	客先検査官 不合格 REJECT	備考（欠陥記録） REMARK (DESCRIPTION OF DEFECTS) 単位 UNIT : mm
W105-A	✓	✓								✓	✓			
B	✓	✓												
W106-A	✓	✓												
B	✓	✓												
W107-A	✓	✓												
B	✓	✓												
W108-A	✓	✓												
B	✓	✓												
W109-A	✓	✓												
B	✓	✓												
W110-A	✓	✓												
B	✓	✓												
W111-A	✓	✓												
B	✓	✓												
W112-A	✓	✓												
B	✓	✓												
W113-A	✓					✓								○ T1N0.84
B	✓	✓												
W114-A	✓	✓												
B	✓	✓												

石川島検査計測株式会社

ISHIKAWAJIMA Industrial Corporation

放射線透過検査記録
RADIOGRAPHIC EXAMINATION RECORD

記録番号 RECORD No. 96 (18/18)

結果 RESULT / フィルム番号 FILM No.	濃度 DENSITY CHECK	無欠陥 NO APPARENT DEFECT	第一種 ROUNDED INDUCTION	第二種 ELONGATED SLAG	第三種 CRACK	第四種 TUNGSTEN INCL.	混在 EXISTING TOGETHER	溶込不良 INCOMPLETE PENETRATION	融合不良 LACK OF FUSION	判定結果 JUDGEMENT 社内検査 合格 ACCEPT-ABLE	社内検査 不合格 REJECT	客先検査官 CUSTOMER INSPECTOR OWNER SURVEYOR 合格 ACCEPT-ABLE	客先検査官 不合格 REJECT	備考(欠陥記録) REMARK (DESCRIPTION OF DEFECTS) 単位 UNIT : mm
W115-A	✓		✓							14.10				○ por 1.2φ
B	✓	✓												
W116-A	✓	✓												
B	✓	✓												
W117-A	✓	✓												
B	✓	✓												

MISUZU

INSPECTION REPORT

CUSTOMER : ELLIOTT-EBARA TURBOMACHINERY CORPORATION

EBARA SER. NO. : R0215708

ARTICLE : LUBE OIL CONSOLE UNIT

ITEM NO. : CT-9901/TC-9901

PARTS NAME : OIL PIPING

SERIAL NO. : U-2549

INSPECTION ITEM : HYDROSTATIC PRESSURE TEST

INSPECTION DATE : 7th Oct. 2003

TEST PRESSURE :

・Pump discharge line	33.0 kg/cm^2 G.
・Lube Oil supply , Pump suction line & Oil return line	7.5 kg/cm^2 G.
・Instrument air piping	12.0 kg/cm^2 G.
・Turbine Midle steam piping	24.9 kg/cm^2 G.
・Turbine Drain line	10.7 kg/cm^2 G.
・Cooling Water line	13.5 kg/cm^2 G.
・N 2 Parge line	12.0 kg/cm^2 G.

HOLDING TIME : 30 Minutes

LIQUID : FRESH WATER

AMBIENT TEMPERATURE : 22.0 ℃

MATERIAL : A312TP304-S, A53 GR.B

TEST RESULT : ACCEPTABLE (NO LEAKAGE)

REMARKS :

Certified by : H. Tanaka

Inspected by :

MISUZU Industrial Corporation

MISUZU

INSPECTION REPORT

CUSTOMER : ELLIOTT EBARA TURBO MACHINERY CORPORATION	EBARA SER. NO. : R021570804
ARTICLE : LUBE OIL CONSOLE UNIT	ITEM NO. : CT-9901/TC-9901
ITEM : PUMP	SERIAL NO. : U-2549
DRAWING NO. : ER021570804/902 (K1-01692)	INSPECTION DATE : 30th OCT. 2003

CUSTOMER : LG ENGINEERING & CONSTRUCTION CORP.

FINAL USER : TURKISH PETROLEUM REFINERIES CORP.

PROJECT : TUPRAS IZMIR REFINERY DHP PROJECT

JOB. NO. : 7020

SERVICE : RECYCLE GAS COMPRESSOR

ITEM NO. CT-9901PT1A
CT-9901PM1B

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed

EETC Q.C Dept.

Certified by :

Inspected by : H. Tanaka

MISUZU Industrial Corporation

SURVEYOR	CUSTOMER MISUZU Industrial Corporation
	Ebara Corporation / LG Engineering
	Turkish Petroleum Refineries Corp.

NOTES

O/# : U-2549

ITEM NO. CT-9901PT1A / PM1B

MAIN AND STD'BY OIL PUMP

TEST REPORT

PARTICULARS

TYPE	GH−R2T−118
CAPACITY	18.5 m³/h
DISCH. PRESS.	17.5 kgf/cm²
SUC. PRESS.	0 kgf/cm²
SPEED	2950 rpm

DATE OF TEST	AUG. 6. '03
SERIAL NO.	P3−33983−1, 2

Kosaka Laboratory Ltd.
TOKYO JAPAN

HYDRAULICS DIV. TEST SEC.	CHIEF OF SECTION	A. Yamaguchi
	CHECKED BY	Y. Satoh
	DRAWN BY	K. Saito
DRAWING NO.	P3T−33983	

SCREW PUMP TEST REPORT

Pump Type GH-R2T-118 Serial No. P3-33983-1 Date AUG.6.'03

RATING

Capacity	[m3/h]	18.5	Motor		Test Motor
Disch.Press.	[kgf/cm2]	17.5	Output	[kW]	18.5
Suc. Press.	[kgf/cm2]	0	Voltage	[V]	380
			Ampere	[A]	37
Speed	[rpm]	2950	Speed	[rpm]	2900
Test Liquid		ISO VG32	Serial No.		----

CONTINUOUS RUNNING TEST

Item	1	2	3	4	CONVERT OIL VIS. cSt	cSt
Time	0-00	0-20	0-40	1-00		
Frequency [Hz]	50.0	50.0	50.0	50.0	13.7	85
Voltage [V]	380	380	380	380		
Current [A]	25.4	24.9	24.6	24.6		
Mot. Input [kW]	13.5	13.3	13.2	13.2		
Mot. Eff. [%]	89.5	89.5	89.5	89.5		
Mot. Output [kW]	12.1	11.9	11.8	11.8	11.5	12.3
Disch.Press [kgf/cm2]	17.3	17.3	17.3	17.3	17.3	17.3
Suc. Press [kgf/cm2]	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
Total Press [kgf/cm2]	17.5	17.5	17.5	17.5	17.5	17.5
Measured Time [sec]	22.1	22.2	22.3	22.3	—	—
Capacity [m3/h]	19.5	19.5	19.4	19.4	18.7	19.6
Hyd. H/P [kW]	9.30	9.30	9.25	9.25	8.91	9.34
Pump Eff. [%]	76.9	78.2	78.4	78.4	77.5	75.9
Speed [rpm]	2963	2955	2957	2955	2950	2950
Theoret.Cap. [m3/h]	20.9	20.8	20.8	20.8	20.8	20.8
Volumet.Eff. [%]	93.3	93.8	93.3	93.3	89.9	94.2
Liquid Temp. [°C]	28.0	29.5	30.5	31.5		
Bearing Temp. [°C]	31.5	42.5	43.5	43.5		
Room Temp. [°C]	30.0	30.0	30.0	30.0		

Measured Capacity 120 [Liter]

Surveyor Chief H.Yamaguchi

Test by M.Saito

S C R E W P U M P T E S T R E P O R T

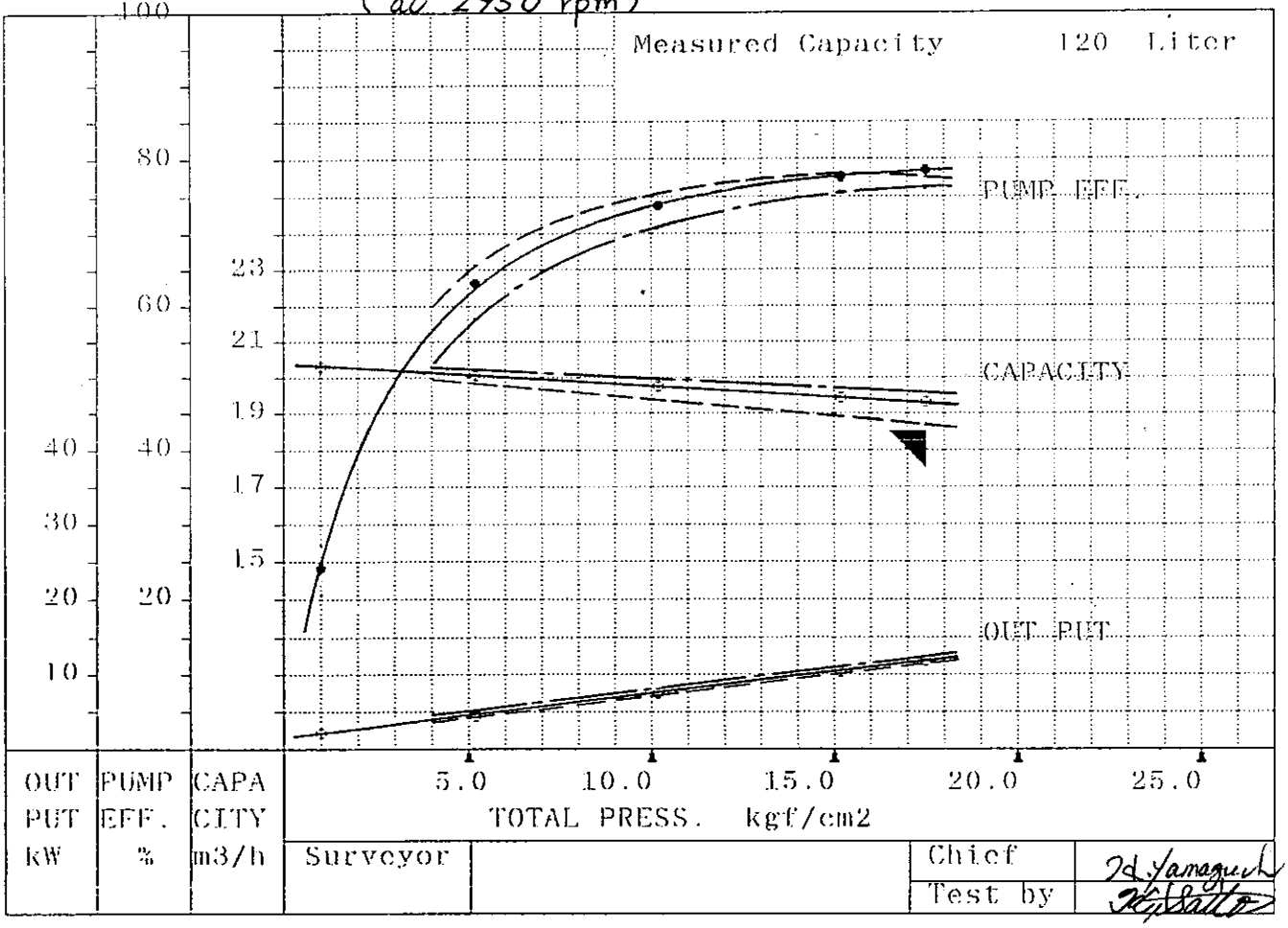
Pump Type GH-R2T-118 Serial No. P3-33983-1 Date AUG.6.'03

PERFORMANCE TEST (Liq.Temp 31.5° C Liq.Vis. 42.7 cSt)
Room Temp. 30.0° C Bearing Temp. 43.5° C

Item		1	2	3	4	5
Frequency	[Hz]	50.0	50.0	50.0	50.0	50.0
Voltage	[V]	380	380	380	380	380
Current	[A]	13.7	15.6	18.8	22.8	24.6
Mot. Input	[kW]	3.20	5.64	8.72	11.7	13.2
Mot. Eff.	[%]	72.5	81.0	86.0	88.5	89.5
Mot. Output	[kW]	2.32	4.57	7.50	10.4	11.8
Disch.Press	[kgf/cm2]	0.8	5.0	10.0	15.0	17.3
Suc. Press	[kgf/cm2]	-0.2	-0.2	-0.2	-0.2	-0.2
Total Press	[kgf/cm2]	1.0	5.2	10.2	15.2	17.5
Measured Time	[sec]	21.0	21.3	21.7	22.1	22.3
Capacity	[m3/h]	20.6	20.3	19.9	19.5	19.4
Hyd. H/P	[kW]	0.561	2.88	5.53	8.07	9.25
Pump Eff.	[%]	24.2	63.0	73.7	77.6	78.4
Speed	[rpm]	2991	2982	2975	2962	2955
Theoret.Cap.	[m3/h]	21.1	21.0	21.0	20.9	20.8
Volum.Eff.	[%]	97.6	96.7	94.8	93.3	93.3
2950rpm Cap.	[m3/h]	20.3	20.1	19.7	19.5	19.3
2950rpm M.O/P	[kW]	2.29	4.52	7.44	10.3	11.8

C H A R A C T E R I S T I C C U R V E S (at 2950 rpm)

42.7 / 13.7 / 85 } cSt



OUT PUT kW	PUMP EFF. %	CAPA CITY m3/h	Surveyor		Chief	
					Test by	

Kosaka Laboratory Ltd.

S C R E W P U M P T E S T R E P O R T

Pump Type GH-R2T-118 Serial No. P3-33983-2 Date AUG.6.'03

RATING

Capacity	[m3/h]	18.5	Motor		Test Motor
Disch.Press.	[kgf/cm2]	17.5	Output	[kW]	18.5
Suc. Press.	[kgf/cm2]	0	Voltage	[V]	380
			Ampere	[A]	37
Speed	[rpm]	2950	Speed	[rpm]	2900
Test Liquid		ISO VG32	Serial No.		----

CONTINUOUS RUNNING TEST

Item	1	2	3	4	CONVERT OIL VIS.	
Time	0-00	0-20	0-40	1-00	cSt	cSt
Frequency [Hz]	50.0	50.0	50.0	50.0	13.7	85
Voltage [V]	380	380	380	380		
Current [A]	25.2	25.0	24.8	24.8		
Mot. Input [kW]	13.4	13.2	13.2	13.2		
Mot. Eff. [%]	89.5	89.5	89.5	89.5		
Mot. Output [kW]	12.0	11.8	11.8	11.8	11.6	12.4
Disch.Press [kgf/cm2]	17.3	17.3	17.3	17.3	17.3	17.3
Suc. Press [kgf/cm2]	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
Total Press [kgf/cm2]	17.5	17.5	17.5	17.5	17.5	17.5
Measured Time [sec]	22.2	22.3	22.4	22.4	—	—
Capacity [m3/h]	19.5	19.4	19.3	19.3	18.6	19.6
Hyd. H/P [kW]	9.30	9.25	9.20	9.20	8.87	9.34
Pump Eff. [%]	77.5	78.4	78.0	78.0	76.5	75.3
Speed [rpm]	2959	2958	2956	2955	2950	2950
Theoret.Cap. [m3/h]	20.8	20.8	20.8	20.8	20.8	20.8
Volumet.Eff. [%]	93.8	93.3	92.8	92.8	89.4	94.2
Liquid Temp. [°C]	31.5	32.5	33.5	34.5		
Bearing Temp. [°C]	32.0	43.0	44.0	44.0		
Room Temp. [°C]	30.0	30.5	30.5	30.5		

Measured Capacity 120 [Liter]

Surveyor Chief H.Yamaguchi

Test by K.Saito

SCREW PUMP TEST REPORT

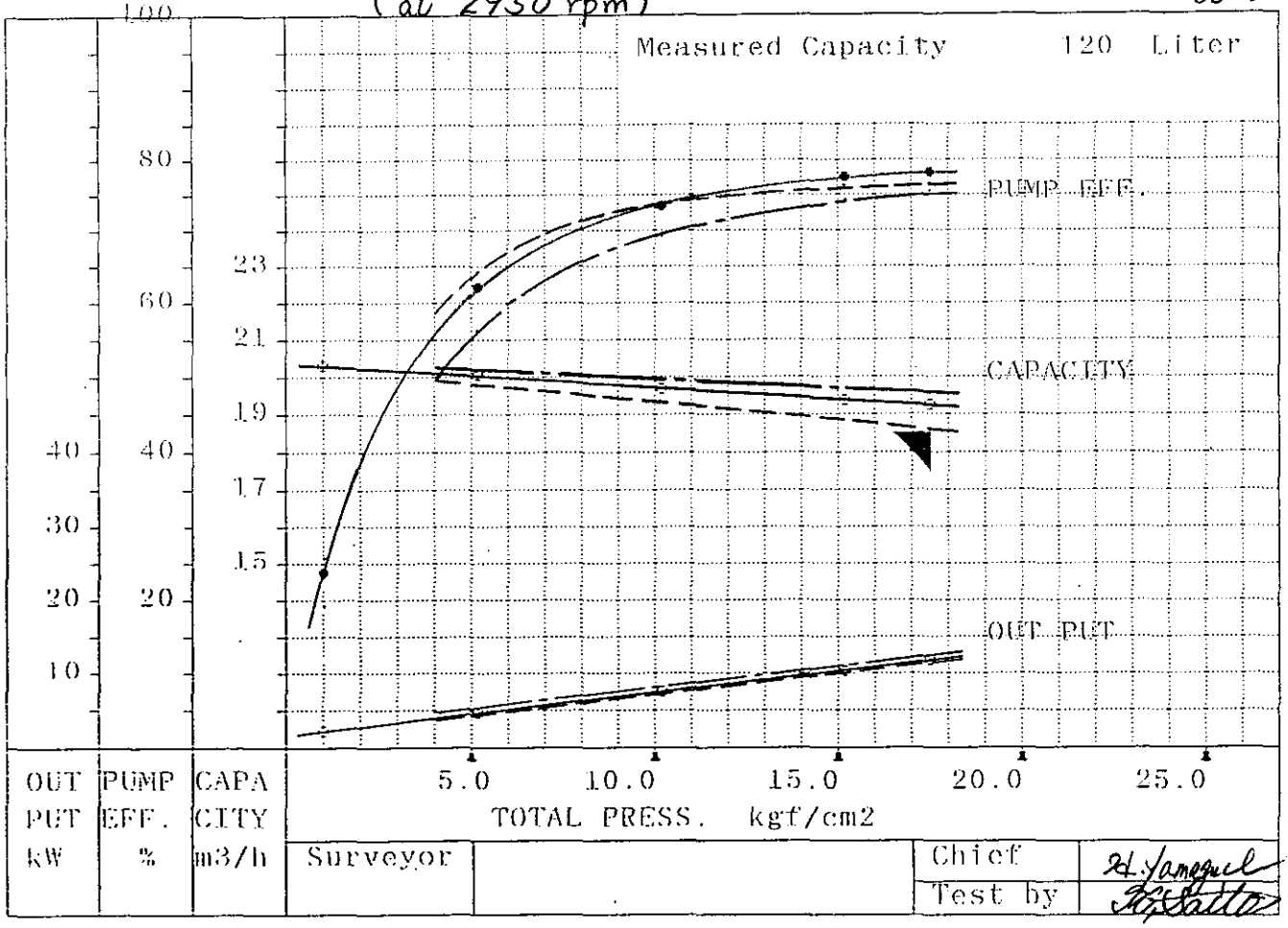
Pump Type GH-R2T-118 Serial No. P3-33983-2 Date AUG.6.'03

PERFORMANCE TEST (Liq.Temp 34.5° C Liq.Vis. 37.4 cSt)
Room Temp. 30.5° C Bearing Temp. 44.0° C

Item		1	2	3	4	5
Frequency	[Hz]	50.0	50.0	50.0	50.0	50.0
Voltage	[V]	380	380	380	380	380
Current	[A]	14.0	15.9	19.1	23.0	24.8
Mot. Input	[kW]	3.24	5.68	8.72	11.8	13.2
Mot. Eff.	[%]	73.0	81.5	86.0	88.5	89.5
Mot. Output	[kW]	2.37	4.63	7.50	10.4	11.8
Disch.Press	[kgf/cm2]	0.8	5.0	10.0	15.0	17.3
Suc. Press	[kgf/cm2]	-0.2	-0.2	-0.2	-0.2	-0.2
Total Press	[kgf/cm2]	1.0	5.2	10.2	15.2	17.5
Measured Time	[sec]	21.0	21.3	21.8	22.2	22.4
Capacity	[m3/h]	20.6	20.3	19.8	19.5	19.3
Hyd. H/P	[kW]	0.561	2.88	5.50	8.07	9.20
Pump Eff.	[%]	23.7	62.2	73.3	77.6	78.0
Speed	[rpm]	2991	2984	2973	2962	2955
Theoret.Cap.	[m3/h]	21.1	21.0	20.9	20.9	20.8
Volum.Eff.	[%]	97.6	96.7	94.7	93.3	92.8
2950rpm Cap.	[m3/h]	20.3	20.1	19.7	19.4	19.3
2950rpm M.O/P	[kW]	2.33	4.58	7.44	10.4	11.8

CHARACTERISTIC CURVES (at 2950 rpm)

37.4 / 13.7 / 85 } cSt

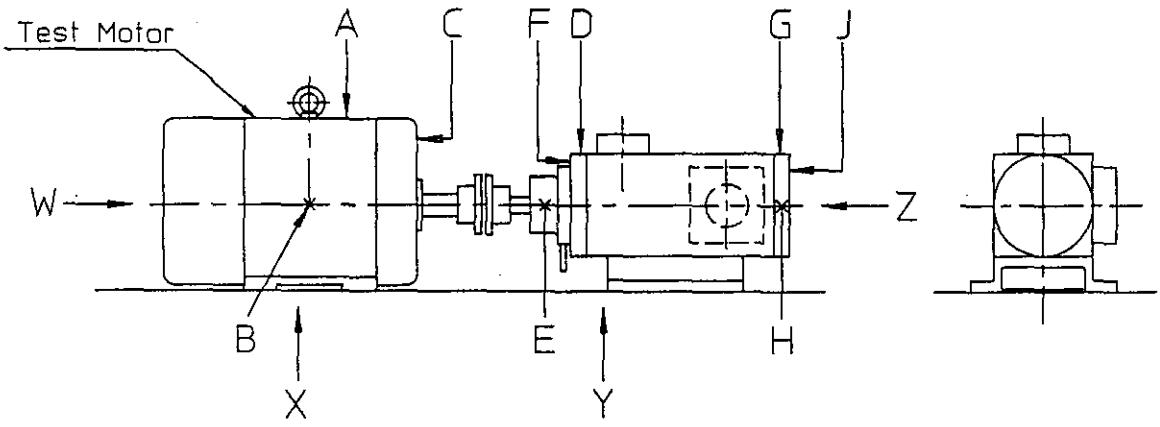


OUT PUT kW	PUMP EFF. %	CAPA CITY m3/h

Surveyor | Chief | Test by

Kosaka Laboratory Ltd.

検査記録 INSPECTION REPORT		品名 ARTICLE MAIN AND STD'BY OIL PUMP	No. 3F122
作番 ORDER No.	P3-33983	騒音&振動値 Noise & Vibration Level	承認 APPROVED H.Yamaguchi
納先/向先 CUSTOMER	MISUZU Industrial Corporation	検査日付 DATE AUG. 6. '03	検査担当 INSPECTOR K.Saito



騒音
Noises Test

Measure point at 1m away
測定距離 1m

単位 Unit dB(A)

測定箇所 Position	W	X	Y	Z
許容値 Allowance Limit	≦ 90			
No. P3-33983-1	76	78	79	75
No. P3-33983-2	77	79	80	75

1) 暗騒音 (Back ground noise) 56 dB(A)

振動
Vibration Test

単位 Unit μm

測定箇所 Position	A	B	C	D	E	F	G	H	J
許容値 Allowance Limit	両振幅 (Peak - Peak) ≦ 30								
No. P3-33983-1	6	9	6	6	5	5	5	5	5
No. P3-33983-2	4	9	3	5	3	3	5	3	4

MISUZU

INSPECTION REPORT

CUSTOMER : ELLIOTT EBARA TURBO MACHINERY CORPORATION	EBARA SER. NO. : R021570804
ARTICLE : LUBE OIL CONSOLE UNIT	ITEM NO. : CT-9901/TC-9901
ITEM : MOTOR	SERIAL NO. : U-2549
DRAWING NO. : ER021570804/902 (K1-01692)	INSPECTION DATE : 30th OCT. 2003

CUSTOMER : LG ENGINEERING & CONSTRUCTION CORP.

FINAL USER : TURKISH PETROLEUM REFINERIES CORP.

PROJECT : TUPRAS IZMIR REFINERY DHP PROJECT

JOB. NO. : 7020

SERVICE : RECYCLE GAS COMPRESSOR

ITEM NO. CT-9901MP1B

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed

EETC Q.C Dept.

Certified by :

Inspected by : H. Tanaka

MISUZU Industrial Corporation

誘導電動機検査成績表
INSPECTION REPORT OF INDUCTION MOTOR

御注文主名 Customer		項目 Pos. No.	03-09D-0-01631
客先番号 Cust's No.	U-7549	製造番号 Work No.	YY39376 01
機番 Serial No.	0309D001631 1	試験日 Test date	11, SEP. 2003
用途 Service	CT-9901MPIB	承認 Approved by / 作成 Prepared by	YAMAMOTO / M.SEKI

形式 Type	MLA6185B	枠番 Fram	180M	相数 Phase	3	出力 Out Put	18.5 kW	極数 Poles	2
電圧 Volts	380 V	周波数 Frequency	50 Hz	電流 Current	34 A	回転数 Revolution	2935 r/min	絶縁 Insul.	F
定格 Rating	S1	二次電圧 Sec. Volt	V	二次電流 Sec. Current	A	規格 Rule	IEC60034-1(1996)		

特性試験 Characteristics Test

巻線抵抗 (Ω) Winding Resistance		周囲温度 Amb. Temp. (℃)	周波数 Frequency (Hz)	無負荷試験 No Load Test			拘束試験 Locked Rotor Test			極数 Poles
単相:主 1 Phase : Main 三相:固定子 3 Phase : Stator	単相:補助 1 Phase : Aux. 三相:回転子 3Phase : Rotor			電圧(V) Volts	電流(A) Current	入力(W) Watts	電圧(V) Volts	電流(A) Current	入力(W) Watts	
0.325		29.0	50	380	6.8	1600	59.4	34.0	1590	2
			25				34.7	34.0	1272	

負荷特性 Load Characteristics Test

単相:(実負荷試験) 1 Phase : (Actual Load Test)　三相:(円線図法による) 3 Phase : (Circle Diagram Method)

	50 (Hz), 380 (V), 2 (P),					(Hz),		(V),		(P),
負荷率 (%) Load	25	50	75	100	125	25	50	75	100	125
電流 (A) Current	11.6	18.3	25.7	33.6	41.9					
効率 (%) Efficiency	73.6	83.5	86.7	87.8	87.9					
力率 (%) Power Factor	82.3	91.8	94.4	95.2	95.3					
滑り (%) Slip	0.48	0.99	1.52	2.09	2.71					

	50 Hz 380 V			固定子 Stator	回転子 Rotor	振動 (全振幅) Vibration (Peak to Peak)
最大出力 (%) Max. Output	280		絶縁抵抗 Insul. Resistance (by 500V Megger)	100 (MΩ) more than	– (MΩ) more than	μm
最大トルク (%) Breakdown Torque	317					外観・構造・寸法検査 : 良
最小始動トルク (%) Locked Rotor Torque	222		絶縁耐力 Dielectric Strength (A·C60Hz)	2000 (V) for 1 min. Good	– (V) for 1 min. Good	Inspection of Outer View Construction & Dimension : Good
最大始動電流 (A) Locked Rotor Current	217.5					

NOISE TEST --- DECIBEL (A) : AVERAGE ; 81.5　BACK GROUND NOISE ; 51.0
(FULL LOAD)

ELLIOTT COMPANY

Quality Assurance Documentation

INSPECTION AND TEST RECORD

Purchaser: **EETC**

User: **TUPRAS**

Purchase Order: **CE07008/R021570821**

Equipment: **PYR Turbine Class III**

Elliott Shop Order: **E302507B**

Quality Technician Annette O'Donnell

Annette O'Donnell

Project Engineer Ted Fitzpatrick

Ted Fitzpatrick

R021570821
25MB5/SRV-5DF
Item No.: CT-9901/TC-9901
Oil Console Unit
Part Name:
Lube Oil Pump Driver Turbine
(Tag No.: CT-9901TP1A)

LG E&C | INSPECTION TEAM ☐WITNESSED ☑REVIEWED Nov. 13, 2015

ELLIOTT EDARA GROUP ☐Witnessed ☑Reviewed

EETC Q.C Dept.

Certification of Hydrotest

ELLIOTT EBARA GROUP

QUALITY ASSURANCE PRESSURE TEST CERTIFICATION

FORM 19A (10/01/01)

Elliott Turbomachinery Co., Inc.
901 North Fourth Street
Jeannette, PA 15644-1473 USA

Customer:

Type of Test: ☒ Water ☐ Nitrogen ☐ Helium ☐ Oil ☐ Other:

Shop Order:	Duration of Test(s):	Date of Test(s):
E302507B	☒ 30 minutes ☐ Other:	6-4-03

Part Name: CASING **Apparatus Code:** 02 **Applicable Specs:** SP-527

PART NUMBER	QTY.	PART SERIAL NUMBER	TEST PRESS. PSIG	GAGE NUMBER	RANGE PSIG	CALIBRATION DATE	ACTUAL PRESS. PSIG	INSP.
CY0050-21	1	518937	150	1107-24	0-300	2-7-03	170	@ 10

Remarks: Cover (casting) Steam End (casting) Exh. End (casting) Steam Chest (casting)

Pt # CY0033-A	Pt # CY0031-A	Pt # CY0032-A	Pt #
P.O. P205896	P.O. P217309	P.O. P217309	P.O.
S/N 1429	S/N 2621	S/N 2606	S/N

Approvals

Foreman:	Date:	Inspector: @ 10	Date: 6-4-03
Customer Witness:	Date:	Customer Witness:	Date:

LG E&C

INSPECTION TEAM
☐ WITNESSED ☒ REVIEWED
Nov. 13, 2003

ELLIOTT EBARA GROUP

QUALITY ASSURANCE PRESSURE TEST CERTIFICATION

FORM 19A (10/01/01)

Elliott Turbomachinery Co., Inc.
901 North Fourth Street
Jeannette, PA 15644-1473 USA

109

Customer:

Type of Test: ☒ Water ☐ Nitrogen ☐ Helium ☐ Oil ☐ Other:

Shop Order: E302507 B

Duration of Test(s): ☒ 30 minutes ☐ Other:

Date of Test(s): 5-22-03

Part Name: Steam Chest

Apparatus Code: 02

Applicable Specs: SP-527

PART NUMBER	QTY.	PART SERIAL NUMBER	TEST PRESS. PSIG	GAGE NUMBER	RANGE PSIG	CALIBRATION DATE	ACTUAL PRESS. PSIG	INSP.
CY0099-5	1	1213	1165	1107-15	0-2000	1-7-03	1200	EI 10

Remarks:

P205896

1213

Approvals

Foreman:	Date:	Inspector: EI 10	Date: 5-22-03
Customer Witness:	Date:	Customer Witness:	Date:

LG E&C

INSPECTION TEAM
☐ WITNESSED ☒ REVIEWED
Nov. 13, 2003

ELLIOTT EBARA GROUP

QUALITY ASSURANCE PRESSURE TEST CERTIFICATION

FORM 19A (10/01/01)

Elliott Turbomachinery Co., Inc.
901 North Fourth Street
Jeannette, PA 15644-1473 USA

Customer: 110

Type of Test: ☒ Water ☐ Nitrogen ☐ Helium ☐ Oil ☐ Other:

Shop Order: E302507B

Duration of Test(s): ☒ 30 minutes ☐ Other:

Date of Test(s): 5-20-03

Part Name: Steam Evo

Apparatus Code: 02

Applicable Specs: SP-527

PART NUMBER	QTY.	PART SERIAL NUMBER MPO	TEST PRESS. PSIG	GAGE NUMBER	RANGE PSIG	CALIBRATION DATE	ACTUAL PRESS. PSIG	INSP.
CY0103-5	1	518938	1165	1107-15	0-2000	1-7-03	1180	
				1107-26	0-2000	2-10-03	1180	

Remarks:

P217309
2621

Approvals

Foreman:	Date:	Inspector: Adam Ebensberger @ 10	Date: 5-20-03
Customer Witness:	Date:	Customer Witness:	Date:

LG E&C

INSPECTION TEAM
☐ WITNESSED ☒ REVIEWED
Nov. 13, 2003

Rotor Assembly

ELLIOTT

BALANCING RECORD

901 N. 4th St.
Jeannette, PA 15644

111

SET-UP

Balancing Machine EC No.: 1107-0001 | Dept. No.: 1149 | [X] Original Balance [ ] Check Balance [ ] Rebalance

Drive Arrangement: [X] Belt [ ] Direct | Adapter No.: T- | Support Arrangement: [X] Roller [ ] Sleeve Bearings | Bearing No.: T- T-

Balancing Arbor: T- | Balancing Arbor Check Balanced? [ ] Yes [ ] No | Workpiece Supported: [X] Between Pedestals [ ] Overhung

Drive Adapter Rotated 180° to Check Balance? [ ] Yes [ ] No | Rotor Thrust End Is: [ ] Left Side [X] Right Side | Weight of Part: 75#

BALANCE

Part No.	Draw No.	Type App.	S.O. No. (WBS)	Serial No.	MPO No.
CY0018-203	CY0018-203	PYR	E302507	RBS 0296	518935

Working Inspection: [ ] Journals Scored* [ ] Shaft End Tapers Scored* [ ] Seal Rubs* [ ] Impeller or Disc Damage* [ ] Drive Coupling Mounted [ ] Field Balance Weights Installed [ ] Couplings or Impeller Half-Keys Installed [ ] Thrust Disc Mounted *Inspector to be Notified

Balancing Speed: 1000 RPM | Balancing Procedure Required: [ ] Single Plane [X] Two-Plane [ ] Three-Plane [ ] Incremental

Identify Zero Phase Angle Relative to some Stationary Part of the Workpiece: KEYWAY

UNBAL. TOLER.

Left Side	Right Side	Total
.05 Oz.-In.	.05 Oz.-In.	.1 Oz.-In.

Use Check Piece Ten (10) Times the Amount Allowed per Drawing Tolerance (Unbal. Tol. ÷ Radius x 10 = 10W (weight of set-up piece)

Left Side Oz. | Right Side Oz.

UNBALANCE AS RECEIVED

Balancing Machine Reading: [X] Heavy [ ] Light | Distance Between Set-up Planes: 2.5 Inches

LEFT SIDE				RIGHT SIDE			
Weight	Radius	Amt (Oz x In)	Phase Angle	Weight	Radius	Amt (Oz x In)	Phase Angle
.109 Oz.	5. In.	.545	230°	.162 Oz.	5. In.	.81	138°

RESOLUTION OF UNBAL.

LEFT SIDE				RIGHT SIDE			
Weight	Radius	Amt (Oz x In)	Phase Angle	Weight	Radius	Amt (Oz x In)	Phase Angle
.002 Oz.	5. In.	.01	275°	.002 Oz.	5. In.	.01	345°

STATIC CORRECTION

Weight	Radius	Amt (Oz x In)	Phase Angle
Oz.	In.		°

RESIDUAL UNBALANCE CHECK

LEFT SIDE OUNCES	DEGREES	RIGHT SIDE OUNCES
	0°	
	45°	
	90°	
	135°	
	180°	
	225°	
	270°	
	315°	

	LEFT SIDE Set-Up Wt.	LEFT SIDE Machine Reading		RIGHT SIDE Set-Up Wt.	RIGHT SIDE Machine Reading
1/2W			1/2W		
W			W		
2W			2W		
4W			4W		

UNBAL. REMAIN.

Left Side: .01 Oz.-In. ● 275° | Right Side: .01 Oz.-In. ● 345° | [X] ACC. [ ] REJ.

SPIN

Spin Test: RPM for minutes | [ ] Accepted [ ] Rejected

APPROVALS

Balanced By: Tony King	Date: 6/19/03	Review By Customer	Date
Spun By	Date	Reviewed By Customer	Date
		Reviewed by (Inspection Supervisor): Donald J. Hunter	Date: 6/19/03

Form 1794E (11/98)

INSPECTION COPY

INSPECTION TEAM
[ ] WITNESSED [X] REVIEWED
LG E&C
Nov. 13, 2003

ELLIOTT

BALANCING RECORD

901 N. 4th St.
Jeannette, PA 15644

112

SET-UP

Balancing Machine EC No.: 1107-0001 | Dept. No.: 1149 | ☒ Original Balance ☐ Check Balance ☐ Rebalance

Drive Arrangement: ☒ Belt ☐ Direct | Adapter No.: T- | Support Arrangement: ☒ Roller ☐ Sleeve Bearings | Bearing No.: T- T-

Balancing Arbor: T- | Balancing Arbor Check Balanced? ☐ Yes ☐ No | Workpiece Supported: ☒ Between Pedestals ☐ Overhung

Drive Adapter Rotated 180° to Check Balance? ☐ Yes ☐ No | Rotor Thrust End Is: ☐ Left Side ☒ Right Side | Weight of Part:

BALANCE

Part No.	Draw No.	Type App.	S.O. No. (WBS)	Serial No.	MPO No.
CY0005-10	CY0005	Disk	E302507		518935

Working Inspection

☐ Journals Scored* ☐ Shaft End Tapers Scored* ☐ Seal Rubs* ☐ Impeller or Disc Damage*
☐ Drive Coupling Mounted ☐ Field Balance Weights Installed ☐ Couplings or Impeller Half-Keys Installed ☐ Thrust Disc Mounted

*Inspector to be Notified

Balancing Speed: 800 RPM | Balancing Procedure Required: ☒ Single Plane ☐ Two-Plane ☐ Three-Plane ☐ Incremental

Identify Zero Phase Angle Relative to some Stationary Part of the Workpiece: KeyWay

UNBAL. TOLER.

Left Side	Right Side	Total
.05 Oz. - In.	.05 Oz. - In.	.1 Oz. - In.

Use Check Piece Ten (10) Times the Amount Allowed per Drawing Tolerance (Unbal. Tol. ÷ Radius x 10 = 10W (weight of set-up piece)

Left Side Oz. | Right Side Oz.

UNBALANCE AS RECEIVED

Balancing Machine Reading: ☒ Heavy ☐ Light | Distance Between Set-up Planes: .75 Inches

STATIC ~~LEFT~~ SIDE

Weight	Radius	Amt (Oz x In)	Phase Angle	Weight	Radius	Amt (Oz x In)	Phase Angle
.177 Oz.	5. In.	.885	167 °	Oz.	In.		°

RIGHT SIDE

RESOLUTION OF UNBAL.

Weight	Radius	Amt (Oz x In)	Phase Angle	Weight	Radius	Amt (Oz x In)	Phase Angle
Oz.	In.		°	Oz.	In.		°

STATIC CORRECTION

Weight	Radius	Amt (Oz x In)	Phase Angle
.002 Oz.	5. In.	.01	214 °

RESIDUAL UNBALANCE CHECK

LEFT SIDE OUNCES	DEGREES	RIGHT SIDE OUNCES
	0 °	
	45 °	
	90 °	
	135 °	
	180 °	
	225 °	
	270 °	
	315 °	

	LEFT SIDE Set-Up Wt.	LEFT SIDE Machine Reading	RIGHT SIDE Set-Up Wt.	RIGHT SIDE Machine Reading
1/2W			1/2W	
W			W	
2W			2W	
4W			4W	

UNBAL. REMAIN.

Left Side: ° Oz. - In ● | Right Side: ° Oz. - In ● | ☐ ACC. ☐ REJ.

SPIN

Spin Test: RPM for minutes | ☐ Accepted ☐ Rejected

APPROVALS

Balanced By: Tony King	Date: 6/18/03	Review By Customer	Date
Spun By	Date	Reviewed By Customer	Date
		Reviewed by (Inspection Supervisor): Robert Hutchison	Date: 6/18/03

Form 1794E (11/98)

INSPECTION COPY

LG E&C — INSPECTION TEAM ☐ WITNESSED ☒ REVIEWED — Nov. 3, 2003

ELLIOTT

BALANCING RECORD

901 N. 4th St.
Jeannette, PA 15644

113

SET-UP

Balancing Machine EC No.: 1107-0001 | Dept. No.: 1149 | ☒ Original Balance ☐ Check Balance ☐ Rebalance

Drive Arrangement: ☒ Belt ☐ Direct | Adapter No.: T- | Support Arrangement: ☒ Roller ☐ Sleeve Bearings | Bearing No.: T- T-

Balancing Arbor: T- | Balancing Arbor Check Balanced? ☐ Yes ☐ No | Workpiece Supported: ☒ Between Pedestals ☐ Overhung

Drive Adapter Rotated 180° to Check Balance? ☐ Yes ☐ No | Rotor Thrust End Is: ☐ Left Side ☒ Right Side | Weight of Part:

BALANCE

Part No.	Draw No.	Type App.	S.O. No. (WBS)	Serial No.	MPO No.
CY0006-10	CY0006	DISK	E302507		578935

Working Inspection

☐ Journals Scored* ☐ Shaft End Tapers Scored* ☐ Seal Rubs* ☐ Impeller or Disc Damage*

☐ Drive Coupling Mounted ☐ Field Balance Weights Installed ☐ Couplings or Impeller Half-Keys Installed ☐ Thrust Disc Mounted

*Inspector to be Notified

Balancing Speed: 800 RPM | Balancing Procedure Required: ☐ Single Plane ☒ Two-Plane ☐ Three-Plane ☐ Incremental

Identify Zero Phase Angle Relative to some Stationary Part of the Workpiece: KEYWAY

UNBAL. TOLER.

Left Side	Right Side	Total
.05 Oz. - In.	.05 Oz. - In.	1.1 Oz. - In.

Use Check Piece Ten (10) Times the Amount Allowed per Drawing Tolerance (Unbal. Tol. ÷ Radius x 10 = 10W (weight of set-up piece)

Left Side Oz. | Right Side Oz.

UNBALANCE AS RECEIVED

Balancing Machine Reading: ☒ Heavy ☐ Light | Distance Between Set-up Planes: .75 Inches

STATIC ~~LEFT SIDE~~

Left Side Weight	Radius	Amt (Oz x In)	Phase Angle	Right Side Weight	Radius	Amt (Oz x In)	Phase Angle
.068 Oz.	5. In.	.34	308°	Oz.	In.		°

RESOLUTION OF UNBAL.

Left Side Weight	Radius	Amt (Oz x In)	Phase Angle	Right Side Weight	Radius	Amt (Oz x In)	Phase Angle
Oz.	In.		°	Oz.	In.		°

STATIC CORRECTION

Weight	Radius	Amt (Oz x In)	Phase Angle
.003 Oz.	5. In.	.015	265°

RESIDUAL UNBALANCE CHECK

LEFT SIDE OUNCES	DEGREES	RIGHT SIDE OUNCES
	0°	
	45°	
	90°	
	135°	
	180°	
	225°	
	270°	
	315°	

LEFT SIDE Set-Up Wt.	LEFT SIDE Machine Reading	RIGHT SIDE Set-Up Wt.	RIGHT SIDE Machine Reading
1/2W		1/2W	
W		W	
2W		2W	
4W		4W	

UNBAL. REMAIN.

Left Side: ° Oz. - In @ | Right Side: ° Oz. - In @ | ☐ ACC. ☐ REJ.

SPIN

Spin Test: RPM for minutes | ☐ Accepted ☐ Rejected

APPROVALS

Balanced By: Elmer King	Date: 6/18/03	Review By Customer	Date
Spun By	Date	Reviewed By Customer	Date
		Reviewed by (Inspection Supervisor)	Date

Form 1794E (11/96)

INSPECTION COPY

LG E&C

INSPECTION TEAM
☐ WITNESSED ☒ REVIEWED
Nov. 13, 2003

ELLIOTT

BALANCING RECORD

901 N. 4th St.
Jeannette, PA 15644

114

SET-UP

Balancing Machine EC No.: 1107-0001 | Dept. No.: 1149 | [X] Original Balance [ ] Check Balance [ ] Rebalance

Drive Arrangement: [X] Belt [ ] Direct | Adapter No.: T- | Support Arrangement: [X] Roller [ ] Sleeve Bearings | Bearing No.: T- T-

Balancing Arbor: T- | Balancing Arbor Check Balanced? [ ] Yes [ ] No | Workpiece Supported: [X] Between Pedestals [ ] Overhung

Drive Adapter Rotated 180° to Check Balance? [ ] Yes [ ] No | Rotor Thrust End Is: [ ] Left Side [X] Right Side | Weight of Part: 75#

BALANCE

Part No.	Draw No.	Type App.	S.O. No. (WBS)	Serial No.	MPO No.
CY0018-203	CY0018	PYR	E3025075	RBS 0297	518943

Working Inspection: [ ] Journals Scored* [ ] Shaft End Tapers Scored* [ ] Seal Rubs* [ ] Impeller or Disc Damage* [ ] Drive Coupling Mounted [ ] Field Balance Weights Installed [ ] Couplings or Impeller Half-Keys Installed [ ] Thrust Disc Mounted *Inspector to be Notified

Balancing Speed: 1000 RPM | Balancing Procedure Required: [ ] Single Plane [X] Two-Plane [ ] Three-Plane [ ] Incremental

Identify Zero Phase Angle Relative to some Stationary Part of the Workpiece: Keyway

UNBAL. TOLER.

Left Side	Right Side	Total
.05 Oz. - In.	.05 Oz. - In.	.1 Oz. - In.

Use Check Piece Ten (10) Times the Amount Allowed per Drawing Tolerance (Unbal. Tol. ÷ Radius x 10 = 10W (weight of set-up piece)

Left Side Oz. | Right Side Oz.

UNBALANCE AS RECEIVED

Balancing Machine Reading: [X] Heavy [ ] Light | Distance Between Set-up Planes: 2.5 Inches

LEFT SIDE Weight	Radius	Amt (Oz x In)	Phase Angle	RIGHT SIDE Weight	Radius	Amt (Oz x In)	Phase Angle
.229 Oz.	5. In.	1.145	196 °	.149 Oz.	5. In.	.745	36 °

RESOLUTION OF UNBAL.

LEFT SIDE Weight	Radius	Amt (Oz x In)	Phase Angle	RIGHT SIDE Weight	Radius	Amt (Oz x In)	Phase Angle
.002 Oz.	5. In.	.01	301 °	.002 Oz.	5. In.	.01	94 °

STATIC CORRECTION

Weight	Radius	Amt (Oz x In)	Phase Angle
Oz.	In.		°

RESIDUAL UNBALANCE CHECK

LEFT SIDE OUNCES	DEGREES	RIGHT SIDE OUNCES
	0 °	
	45 °	
	90 °	
	135 °	
	180 °	
	225 °	
	270 °	
	315 °	

	LEFT SIDE Set-Up Wt.	LEFT SIDE Machine Reading	RIGHT SIDE Set-Up Wt.	RIGHT SIDE Machine Reading
1/2W				
W				
2W				
4W				

UNBAL. REMAIN.

Left Side: .01 Oz. - In @ 301 ° | Right Side: .01 Oz. - In @ 94 ° | [X] ACC. [ ] REJ.

SPIN

Spin Test: RPM for minutes | [ ] Accepted [ ] Rejected

APPROVALS

Balanced By: Gary King	Date: 6/19/03	Review By Customer	Date
Spun By	Date	Reviewed By Customer	Date
		Reviewed by (Inspection Supervisor): Robert J. Hunt	Date: 6/19/03

Form 1794E (11/98)

INSPECTION COPY

LG E&C — INSPECTION TEAM [ ] WITNESSED [X] REVIEWED Nov. 13, 2003

ELLIOTT

BALANCING RECORD

901 N. 4th St.
Jeannette, PA 15644

115

SET-UP

Balancing Machine EC No.: 1107-0001	Dept. No.: 1149	☒ Original Balance ☐ Check Balance ☐ Rebalance	
Drive Arrangement: ☒ Belt ☐ Direct	Adapter No.: T-	Support Arrangement: ☒ Roller ☐ Sleeve Bearings	Bearing No.: T- T-
Balancing Arbor: T-	Balancing Arbor Check Balanced? ☐ Yes ☐ No	Workpiece Supported: ☒ Between Pedestals ☐ Overhung	
Drive Adapter Rotated 180° to Check Balance? ☐ Yes ☐ No	Rotor Thrust End Is: ☐ Left Side ☒ Right Side	Weight of Part	

BALANCE

Part No.	Draw No.	Type App.	S.O. No. (WBS)	Serial No.	MPO No.
CY00005-10	CY00005	Disk	E30250755		518943

Working Inspection

☐ Journals Scored* ☐ Shaft End Tapers Scored* ☐ Seal Rubs* ☐ Impeller or Disc Damage*

☐ Drive Coupling Mounted ☐ Field Balance Weights Installed ☐ Couplings or Impeller Half-Keys Installed ☐ Thrust Disc Mounted

*Inspector to be Notified

Balancing Speed: RPM

Balancing Procedure Required: ☐ Single Plane ☐ Two-Plane ☐ Three-Plane ☐ Incremental

Identify Zero Phase Angle Relative to some Stationary Part of the Workpiece:
KeyWAY

UNBAL. TOLER.

Left Side	Right Side	Total
.05 Oz. - In.	.05 Oz. - In.	.1 Oz. - In.

Use Check Piece Ten (10) Times the Amount Allowed per Drawing Tolerance (Unbal. Tol. ÷ Radius x 10 = 10W (weight of set-up piecs)

Left Side Oz. Right Side Oz.

UNBALANCE AS RECEIVED

Balancing Machine Reading: ☒ Heavy ☐ Light

Distance Between Set-up Planes: .75 Inches

STATIC ~~LEFT SIDE~~ RIGHT SIDE

Weight	Radius	Amt (Oz x In)	Phase Angle	Weight	Radius	Amt (Oz x In)	Phase Angle
.105 Oz.	5. In.	.525	315°	Oz.	In.		°

RESOLUTION OF UNBAL.

Weight	Radius	Amt (Oz x In)	Phase Angle	Weight	Radius	Amt (Oz x In)	Phase Angle
Oz.	In.		°	Oz.	In.		°

STATIC CORRECTION

Weight	Radius	Amt (Oz x In)	Phase Angle
.002 Oz.	5. In.	.01	322°

RESIDUAL UNBALANCE CHECK

LEFT SIDE OUNCES	DEGREES	RIGHT SIDE OUNCES
	0°	
	45°	
	90°	
	135°	
	180°	
	225°	
	270°	
	315°	

	LEFT SIDE Set-Up Wt.	LEFT SIDE Machine Reading		RIGHT SIDE Set-Up Wt.	RIGHT SIDE Machine Reading
1/2W			1/2W		
W			W		
2W			2W		
4W			4W		

UNBAL. REMAIN.

Left Side: ° Oz. - In ●

Right Side: ° Oz. - In ●

☐ ACC. ☐ REJ.

SPIN

Spin Test: RPM for minutes ☐ Accepted ☐ Rejected

APPROVALS

Balanced By: [signature]	Date: 6/18/03	Review By Customer	Date
Spun By	Date	Reviewed By Customer	Date
		Reviewed by (Inspection Supervisor)	Date

Form 1794E (11/96)

INSPECTION COPY

INSPECTION TEAM
☐ WITNESSED ☑ REVIEWED
LG E&C
NOV. 18, 2003

ELLIOTT

BALANCING RECORD

901 N. 4th St.
Jeannette, PA 15644

116

SET-UP

Balancing Machine EC No.: 1107 - 0001 | Dept. No.: 1149 | [X] Original Balance [ ] Check Balance [ ] Rebalance

Drive Arrangement: [X] Belt [ ] Direct | Adapter No.: T - | Support Arrangement: [X] Roller [ ] Sleeve Bearings | Bearing No.: T - T -

Balancing Arbor: T - | Balancing Arbor Check Balanced? [ ] Yes [ ] No | Workpiece Supported: [X] Between Pedestals [ ] Overhung

Drive Adapter Rotated 180° to Check Balance? [ ] Yes [ ] No | Rotor Thrust End Is: [ ] Left Side [X] Right Side | Weight of Part:

BALANCE

Part No.	Draw No.	Type App.	S.O. No. (WBS)	Serial No.	MPO No.
CY0006-10	CY0006	Disk	E3025075		518943

Working Inspection

[ ] Journals Scored* [ ] Shaft End Tapers Scored* [ ] Seal Rubs* [ ] Impeller or Disc Damage*
[ ] Drive Coupling Mounted [ ] Field Balance Weights Installed [ ] Couplings or Impeller Half-Keys Installed [ ] Thrust Disc Mounted

*Inspector to be Notified

Balancing Speed: 800 RPM | Balancing Procedure Required: [X] Single Plane [ ] Two-Plane [ ] Three-Plane [ ] Incremental

Identify Zero Phase Angle Relative to some Stationary Part of the Workpiece: KEYWAY

UNBAL. TOLER.

Left Side	Right Side	Total
.05 Oz. - In.	.05 Oz. - In.	.1 Oz. - In.

Use Check Piece Ten (10) Times the Amount Allowed per Drawing Tolerance (Unbal. Tol. ÷ Radius x 10 = 10W (weight of set-up piece)

Left Side Oz. | Right Side Oz.

UNBALANCE AS RECEIVED

Balancing Machine Reading: [X] Heavy [ ] Light | Distance Between Set-up Planes: .75 Inches

STATIC ~~LEFT SIDE~~ RIGHT SIDE

Left Side Weight	Radius	Amt (Oz x In)	Phase Angle	Right Side Weight	Radius	Amt (Oz x In)	Phase Angle
.065 Oz.	5. In.	.325	6 °	Oz.	In.		°

RESOLUTION OF UNBAL.

Left Side Weight	Radius	Amt (Oz x In)	Phase Angle	Right Side Weight	Radius	Amt (Oz x In)	Phase Angle
Oz.	In.		°	Oz.	In.		°

STATIC CORRECTION

Weight	Radius	Amt (Oz x In)	Phase Angle
.003 Oz.	5 In.	.015	261 °

RESIDUAL UNBALANCE CHECK

LEFT SIDE OUNCES	DEGREES	RIGHT SIDE OUNCES
	0 °	
	45 °	
	90 °	
	135 °	
	180 °	
	225 °	
	270 °	
	315 °	

	LEFT SIDE Set-Up Wt.	LEFT SIDE Machine Reading	RIGHT SIDE Set-Up Wt.	RIGHT SIDE Machine Reading
1/2W			1/2W	
W			W	
2W			2W	
4W			4W	

UNBAL. REMAIN.

Left Side: ° Oz. - In ● | Right Side: ° Oz. - In ● | [ ] ACC. [ ] REJ.

SPIN

Spin Test: RPM for minutes | [ ] Accepted [ ] Rejected

APPROVALS

Balanced By: Steve King	Date: 6/19/03	Review By Customer	Date
Spun By	Date	Reviewed By Customer	Date
		Reviewed by (Inspection Supervisor)	Date: 6/19/03.

Form 1794E (11/96)

INSPECTION COPY

INSPECTION TEAM
[ ] WITNESSED [X] REVIEWED
Nov. 13, 2003
LG E&C

No Load Mechanical Testing

ELLIOTT. EBARA GROUP

YR CHECKLIST AND OPERATIONAL TEST REPORT

FORM 2027 (07/20/01)

A. TESTING INSTRUCTIONS (All information in "A" and items marked * to be obtained from Descriptive Specification Form).

Type Turbine	PYRT	Serial No.	E302507B	Rotation ☒CW ☐ CCW (Viewed from Gov. End)	S.O.	
Type Gear		Serial No.		Exhaust ☒ RH ☐ LH ☐ UP ☐ DN	Ratio	
Rated Power	18.5 KW	rpm	2950	Inlet Pressure 159.3 PSIG		
				Inlet Temperature 409°F		
				Exhaust Pressure 39.8		

Type Test ☐ Mechanical Operation – No Load (Std) ☐ Full Load ☒ API 611 4TH Edition

Witness ☐ Required ☐ Waived Min.Test Steam Temp. 372°F

B. PRELIMINARY	Comments	Initials
1. Steam piping, alignment, cooling water, and lubrication setup checked? ☒ Yes ☐ No		
2. Oilers/Standpipes/Oil reservoir set to proper level? ☒ Yes ☐ No		
3. Actual Rotation, ☒ R.H. ☐ L.H. Rotation Arrow: ☒ R.H. ☐ L.H.		

C. TEST	Comments	Initials
1. Sentinel Valve Setting 55 psig Actual 55 psig		
*2. Set trip speed (Desired 3732 Max. 3806) Final 1)3771 2)3760 3)3763 Avg.)	3765	
3. Does machine stop? ☒ Yes ☐ No Slow down to rpm in 15 min.		
4. Actual Gov. speed range 2655 rpm to 3245 rpm		
*5. Adjust speed to approximately 3245 rpm		
6. Hand Valve operation satisfactory? ☒ Yes ☐ No		
7. Packing case sealing and leakoff satisfactory? ☒ Yes ☐ No		
8. Oil leaks corrected? ☐ Yes ☐ No	NA	
9. Steam leaks corrected? ☐ Yes ☐ No	NA	
10. Gov. and valve operating satisfactorily? ☒Yes ☐No		
*Allowable		
11. Excessive vibration, oil, leak, heating? ☐ Yes ☒ No		
*12. Bearing oil pressure (*limits RING OIL) Actual		
13. Test Approved — Test Engineer Signature	Date	
Foreman Signature Bill Trust	Date 7/11/03	
14. Test Approved (If req'd.) — Prod. Engineer Signature	Date	

D. FINAL INSPECTION		
1. Journals and bearings scored excessively? ☐ Yes ☒ No		
2. Carbon Rings removed for shipping? ☐ Yes ☒ No		
3. Electronic Gov. configured for field (if required) ☐ Yes ☐ No	NA	

E. RELEASE FROM TEST		
Test Engineer Signature	Date	8/14/03
Foreman Signature Bill Trust	Date	7/11/03
Customer Witness	Date	

F. COMMENTS: Report difficulties encountered, corrections made, etc.

ROTOR: RBS02-96

Witness WAIVED Bill Trust

LG E&C

INSPECTION TEAM
☐ WITNESSED ☑ REVIEWED
Nov. 13, 2003

ELLIOTT EBARA GROUP

TEMPERATURES AND OIL FLOW

FORM 2027-3 (04/15/02)

							INTERNAL BEARINGS				OIL FLOW	
TIME	Rpm	1	2	3	4	5	6	7	8	9	10	11
		OIL IN	STEAM PRESS	EXHAUST PRESS	STEAM TEMP.	EXHAUST TEMP.	STEAM JOURNAL	ACTIVE THRUST	INACTIVE THRUST	EXHAUST JOURNAL	STEAM	EXHAUST
7:40	2655		200	20	383	267						
7:55	2655		200	20	397	266						
8:00	3245		200	40	365	291						
8:15	3245		200	40	365	290						
8:30	3245		200	40	357	293						
8:45	3245		200	40	372	291						
9:00	3245		200	40	381	290						
9:05	3560		200	15	389	270						
9:20	3560		200	15	355	258						

INSPECTION TEAM
☐ WITNESSED ☑ REVIEWED
LG E&C
Nov. 13, 2003

Data Taken by: 1089 Date: 07/11/03 Test Engineer: Date:

Foreman: Bill Trk Date: 7/11/03 ☐ Proof Test Turbine No.: E302507B

Customer Witness: Date: ☐ Witness Test Rotor: RBS02-96

ELLIOTT EBARA GROUP

VIBRATION DATA FORM 2027-2 (03/30/01)**

TIME	RPM	VIBRATION (VELOCITY) - PEAK TO PEAK STM END CAP	EXH END CAP	STM END SHAFT	EXH END SHAFT	CPLG END SHAFT	THRUST BUMP (MILS) AXIAL	OIL SYSTEM DATA BRG. OIL PRESS.	
7:40	2655	0.05	0.05	0.1	0.1	0.2		RING OIL	
7:55	2655	0.05	0.05	0.05	0.1	0.1			
8:00	3245	0.05	0.05	0.15	0.1	0.15			
8:15	3245	0.05	0.05	0.1	0.1	0.1			
8:30	3245	0.05	0.05	0.1	0.1	0.1			
8:45	3245	0.05	0.1	0.1	0.1	0.15			
9:00	3245	0.05	0.05	0.1	0.1	0.1			
9:05	3560	0.05	0.1	0.15	0.1	0.2			
9:20	3560	0.05	0.1	0.15	0.1	0.1			

TRIP SPEED (RPM)	
REQUIRED:	
3732-3806	
ACTUAL:	3771
	3760
	3763
AVERAGE	3765
OIL PRESSURE TRIP (PSIG)	
LATCH	
UNLATCH	
MIN. GOVERNOR (RPM)	
REQUIRED	2655
ACTUAL	2655
MAX. GOVERNOR (RPM)	
REQUIRED	3245
ACTUAL	3245
AIR SPEED CHANGER	
PSIG	RPM
0	
3	
6	
9	
12	
15	
18	

INSPECTION TEAM
☐ WITNESSED ☑ REVIEWED
LG F&C Nov-13, 2003

DATA TAKEN BY:	1089	DATE: 07/11/03	☐ PROOF TEST	TURBINE S.O.	E302507B
FOREMAN:	Bill Trask	7/11/03	☐ WITNESS TEST	ROTOR:	RBS02-96
CUSTOMER WITNESS:			**NOTE: YOU CANNOT ENTER DATA IN BLUE-SHADED AREAS.		

ELLIOTT. EBARA GROUP

YR CHECKLIST AND OPERATIONAL TEST REPORT

FORM 2027 (07/20/01)

A. TESTING INSTRUCTIONS (All information in "A" and items marked * to be obtained from Descriptive Specification Form).

Type Turbine	PYRT	Serial No.	E302507B	Rotation ☒CW ☐ CCW (Viewed from Gov. End)	S.O.	
Type Gear		Serial No.		Exhaust ☒ RH ☐ LH ☐ UP ☐ DN	Ratio	
Rated Power	18.5 KW	rpm	2950	Inlet Pressure 159.3 PSIG		
				Inlet Temperature 409°F		
				Exhaust Pressure 39.8		

Type Test ☐ Mechanical Operation – No Load (Std) ☐ Full Load ☒ API 611 4TH Edition

Witness ☐ Required ☐ Waived Min.Test Steam Temp. 372°F

B. PRELIMINARY	Comments	Initials
1. Steam piping, alignment, cooling water, and lubrication setup checked? ☒ Yes ☐ No		
2. Oilers/Standpipes/Oil reservoir set to proper level? ☒ Yes ☐ No		
3. Actual Rotation, ☒ R.H. ☐ L.H. Rotation Arrow: ☒ R.H. ☐ L.H.		

C. TEST	Comments	Initials
1. Sentinel Valve Setting 55 psig Actual 55 psig		
*2. Set trip speed (Desired 3732 Max. 3806) Final 1)3806 2)3785 3)3798 Avg.)	3796	
3. Does machine stop? ☒ Yes ☐ No Slow down to rpm in 15 min.		
4. Actual Gov. speed range 2655 rpm to 3245 rpm		
*5. Adjust speed to approximately 3245 rpm		
6. Hand Valve operation satisfactory? ☒ Yes ☐ No		
7. Packing case sealing and leakoff satisfactory? ☒ Yes ☐ No		
8. Oil leaks corrected? ☐ Yes ☐ No	NA	
9. Steam leaks corrected? ☐ Yes ☐ No	NA	
10. Gov. and valve operating satisfactorily? ☒Yes ☐No		
*Allowable		
11. Excessive vibration, oil, leak, heating? ☐ Yes ☒ No		
*12. Bearing oil pressure (*limits RING OIL) Actual		

13. Test Approved	Test Engineer Signature	Date
	Foreman Signature Bill Tuck	Date 7/25/03
14. Test Approved (If req'd.)	Prod. Engineer Signature	Date

D. FINAL INSPECTION		
1. Journals and bearings scored excessively? ☐ Yes ☒ No		
2. Carbon Rings removed for shipping? ☐ Yes ☒ No		
3. Electronic Gov. configured for field (if required) ☐ Yes ☐ No	NA	

E. RELEASE FROM TEST		
	Test Engineer Signature	Date 8/14/03
	Foreman Signature Bill Tuck	Date 7/25/03
	Customer Witness	Date

F. COMMENTS: Report difficulties encountered, corrections made, etc.

ROTOR: RBS02-97

Witness Waived

INSPECTION TEAM ☐WITNESSED ☑REVIEWED

LG E&C Nov. 13, 2003

ELLIOTT EBARA GROUP

TEMPERATURES AND OIL FLOW

FORM 2027-3 (04/15/02)

							INTERNAL BEARINGS			OIL FLOW	
TIME	Rpm	1	2	3	4	5	6	7	8	9	10	11
		OIL IN	STEAM PRESS	EXHAUST PRESS	STEAM TEMP.	EXHAUST TEMP.	STEAM JOURNAL	ACTIVE THRUST	INACTIVE THRUST	EXHAUST JOURNAL	STEAM	EXHAUST
10:25	2655		200	10	382	236						
10:40	2655		200	10	370	230						
10:45	3245		200	40	300	289						
11:00	3245		200	40	350	281						
11:15	3245		200	40	385	292						
11:30	3245		200	40	387	282						
11:45	3245		200	40	385	281						
11:50	3560		200	25	380	282						
12:05	3560		200	25	388	280						

INSPECTION TEAM
☐ WITNESSED ☑ REVIEWED
Nov. 13, 2003

Data Taken by: 1089 Date: 07/10/03 Test Engineer: Date:

Foreman: Bill Tuck Date: 7/10/03 ☐ Proof Test Turbine No.: E302507B SPARE

Customer Witness: Date: ☐ Witness Test Rotor: RBS02-97

ELLIOTT EBARA GROUP

VIBRATION DATA FORM 2027-2 (03/30/01)**

TIME	RPM	VIBRATION (VELOCITY) - PEAK TO PEAK					THRUST BUMP (MILS)	OIL SYSTEM DATA
		STM END CAP	EXH END CAP	STM END SHAFT	EXH END SHAFT	CPLG END SHAFT	AXIAL	BRG OIL PRESS
10:25	2655	0.05	0.1	0.05	0.15	0.2		RING OIL
10:40	2655	0.05	0.1	0.05	0.15	0.15		
10:45	3245	0.05	0.05	0.1	0.15	0.15		
11:00	3245	0.05	0.05	0.05	0.1	0.1		
11:15	3245	0.05	0.05	0.05	0.1	0.1		
11:30	3245	0.05	0.05	0.05	0.1	0.1		
11:45	3245	0.05	0.05	0.05	0.1	0.1		
11:50	3560	0.05	0.1	0.1	0.15	0.15		
12:05	3560	0.05	0.1	0.1	0.15	0.1		

INSPECTION TEAM
☐ WITNESSED ☐ REVIEWED
Nov. 13, 2003

TRIP SPEED (RPM)	
REQUIRED:	
3732-3806	
ACTUAL:	3806
	3785
	3798
AVERAGE	3796

OIL PRESSURE TRIP (PSIG)	
LATCH	
UNLATCH	

MIN. GOVERNOR (RPM)	
REQUIRED	2655
ACTUAL	2655

MAX. GOVERNOR (RPM)	
REQUIRED	3245
ACTUAL	3245

AIR SPEED CHANGER	
PSIG	RPM
0	
3	
6	
9	
12	
15	
18	

DATE:

DATA TAKEN BY: 1089 — 07/10/03 — ☐ PROOF TEST — TURBINE S.O.: E302705B SPARE

FOREMAN: Bill Trad — 7/10/03 — ☐ WITNESS TEST — ROTOR: RBS02-97

CUSTOMER WITNESS:

**NOTE: YOU CANNOT ENTER DATA IN BLUE-SHADED AREAS.

MISUZU

INSPECTION REPORT

CUSTOMER : ELLIOTT EBARA TURBO MACHINERY CORPORATION	EBARA SER. NO. : R021570804
ARTICLE : LUBE OIL CONSOLE UNIT	ITEM NO. : CT-9901/TC-9901
ITEM : CONTROL VALVE	SERIAL NO. : U-2549
DRAWING NO. : ER021570804/902 (K1-01692)	INSPECTION DATE : 30th OCT. 2003

CUSTOMER : LG ENGINEERING & CONSTRUCTION CORP.

FINAL USER : TURKISH PETROLEUM REFINERIES CORP.

PROJECT : TUPRAS IZMIR REFINERY DHP PROJECT

JOB. NO. : 7020

SERVICE : RECYCLE GAS COMPRESSOR

ITEM NO.
TCV-9900-653
PV-9900-661
PCV-9900-656
PCV-9900-657
PCV-9900-658
PCV-9900-659

ELLIOTT EBARA GROUP ☐ Witnessed ☑ Reviewed

EETC Q.C Dept.

Certified by :

Inspected by : H. Tanaka

MISUZU Industrial Corporation

ASSEMBLY TEST REPORT

U-2549

Messers: MISUZU INDUSTRIES LTD. NF No 031393 - 01

Plant:

Tag No: TCV-9900-653 Type Size: 667(34)-ET(1-1/2")-3582

Item No(NF): 4 (904) Body Rating ,Material: ANSI 300 RF ,WCB

SERIAL J149760

TEST RESULTS

Test Item		Test Press	Keep Time (min)	Allow Leak	Actual Leak	Result
Hydro. Test (kg/cm2)	Shell	79.1	10	0	0	GOOD
	Ass'y	52	10	0	0	GOOD
Seat Leak Test (kg/cm2)		3.5	—	231 L/h	0 L/h	GOOD
Actuator Air Test (kg/cm2)	Press.T.	3	5	0	0	GOOD
	LeakT.	2.4	5	0	0	GOOD
Dimmention Inspect.		-	-	-	-	GOOD
Visual Inspect.		-	-	-	-	GOOD

Operation Test Air Faile Close	Signal (kg/cm2)	0% (0.2)	25 (0.4)	50 (0.6)	75 (0.8)	100 (1)	
	St'd (mm)	0	4.75	9.5	14.25	19	GOOD
	Open (mm)	0	4.500	9.400	14.250	19.100	
	Close (mm)	0	4.500	9.400	14.300	19.100	

Max. Travel	St'd	19 mm		Actual	19.1 mm	GOOD
Stroke Speed	Close to Open	3.7 sec		Open to Close	3.9 sec	GOOD
Material Certificate No.:	Body/ 3043		Bonnet/ 201104			

Nippon Fisher Co.,Ltd.
Quality ASsurance dpt.

Approved By S.Kudo 2003.6.17

Checked By S.Kudo 2003.6.17

Certified By M.Hiratori 2003.6.17

ASSEMBLY TEST REPORT

U-2549

Messers: MISUZU INDUSTRIES LTD. NF No 031393 – 02

Plant:

Tag No: PV-9900-661 Type Size: 657(40)-ET(3")

Item No(NF): 1 (911) Body Rating Material: ANSI 300 RF ,WCB

SERIAL J150155

TEST RESULTS

Test Item		Test Press	Keep Time (min)	Allow Leak	Actual Leak	Result
Hydro. Test (kg/cm2)	Shell	79.1	10	0	0	GOOD
	Ass'y	52	10	0	0	GOOD
Seat Leak Test (kg/cm2)		3.5	–	1043 L/h	10 L/h	GOOD
Actuator Air Test (kg/cm2)	Press.T.	3	5	0	0	GOOD
	LeakT.	1.4	5	0	0	GOOD
Dimmention Inspect.		–	–	–	–	GOOD
Visual Inspect.		–	–	–	–	GOOD

Operation Test Air Faile Open							
	Signal (kg/cm2)	0% (1.4)	–	–	–	100 (0)	GOOD
	St'd (mm)	0				38	
	Open (mm)	0	ON	–	OFF	38.60	
	Close (mm)	0					

Max. Travel	St'd	38 mm	Actual	38.6 mm		GOOD
Stroke Speed	Close to Open	0.8 sec	Open to Close	3.9 sec		GOOD
Material Certificate No.:	Body/ 1681		Bonnet/ R695			

Nippon Fisher Co.,Ltd.
Quality ASsurance dpt.

Approved By S.Kuda 2003.9.2

Checked By S.Kuda 2003.9.2

Certified By M.Shiratori 2003.9.2

ASSEMBLY TEST REPORT

U-2549

Messers: MISUZU INDUSTRIES LTD.

Plant: NF No 031393 - 01

Tag No: PCV-9900-656 Type Size: 655(43)-ED(2")

Item No(NF): 1 (901) Body Rating Material: ANSI 300 RF ,WCB

SERIAL J149757

TEST RESULTS

Test Item		Test Press	Keep Time (min)	Allow Leak	Actual Leak	Result
Hydro. Test (MPa)	Shell	79.1	10	0	0	GOOD
	Ass'y	52	10	0	0	GOOD
Seat Leak Test (MPa)		3.5	-	9622 L/h	2200 L/h	GOOD
Actuator Air Test (kPa)	Press.T.		-	-	-	-
	LeakT.	2.81	5	-	-	GOOD
Dimmention Inspect.		-	-	-	-	GOOD
Visual Inspect.		-	-	-	-	GOOD
Operation Test Air Faile Open		Control Pressure Range: 1.34 - 2.81 kg/cm2 Set: 2.64 kg/cm2				GOOD
Max. Travel	St'd	6.4 mm		Actual	6.7 mm	GOOD
Material Certificate No.:	Body/ 11739		Bonnet/ 201104			

Nippon Fisher Co.,Ltd.
Quality ASsurance dpt.

Approved By A.Kudo 2003.7.4.

Checked By A.Kudo 2003.7.4.

Certified By M.Hiratori 2003.7.4

FORM Q-1009

ASSEMBLY TEST REPORT

U-2549

Messers: MISUZU INDUSTRIES LTD. NF No 031393 - 01

Plant:

Tag No: PCV-9900-657 Type Size: 655(3A)-ED(1")

Item No(NF): 2 (902) Body Rating Material: ANSI 300 RF ,WCB

SERIAL J149758

TEST RESULTS

Test Item		Test Press	Keep Time (min)	Allow Leak	Actual Leak	Result
Hydro. Test (kg/cm2)	Shell	79.1	10	0	0	GOOD
	Ass'y	52	10	0	0	GOOD
Seat Leak Test (kg/cm2)		3.5	–	4730 L/h	1500 L/h	GOOD
Actuator Air Test (kg/cm2)	Press.T.		–	–	–	–
	LeakT.	9.49	5	–	–	GOOD
Dimmention Inspect.		–	–	–	–	GOOD
Visual Inspect.		–	–	–	–	GOOD
Operation Test Air Faile Open		Control Pressure Range: 3.1 – 9.49 kg/cm2 Set: 8.59 kg/cm2				GOOD
Max. Travel		St'd	6.4 mm	Actual	6.7 mm	GOOD
Material Certificate No.:		Body/ 13358		Bonnet/ H62952		

Nippon Fisher Co.,Ltd.
Quality ASsurance dpt.

Approved By S.Kudo 2003.6.12

Checked By S.Kudo 2003.6.12

Certified By M.Shiratori 2003.6.12

FORM Q-1009

ASSEMBLY TEST REPORT

U-2549

Messers: MISUZU INDUSTRIES LTD. NF No 031393 - 01

Plant:

Tag No: PCV-9900-658 Type Size: 1BR-EDR(1-1/2")

Item No(NF): 3 (903) Body Rating Material: ANSI 300 RF ,WCB

SERIAL J149759

TEST RESULTS

Test Item		Test Press	Keep Time (min)	Allow Leak	Actual Leak	Result
Hydro. Test (kg/cm2)	Shell	79.1	10	0	0	GOOD
	Ass'y	52	10	0	0	GOOD
Seat Leak Test (kg/cm2)		3.5	—	7322 L/h	750 L/h	GOOD
Actuator Air Test (kg/cm2)	Press.T.		-	-	-	-
	LeakT.	16.1	5	-	-	GOOD
Dimmention Inspect.		-	-	-	-	GOOD
Visual Inspect.		-	-	-	-	GOOD
Operation Test Air Faile Close		Control Pressure Range: 13.8 - 16.1 kg/cm2 Set: 15 kg/cm2				GOOD
Max. Travel	St'd	6.4 mm		Actual	6.5 mm	GOOD
Material Certificate No.:	Body/ 864		Bonnet/ 82940			

Nippon Fisher Co.,Ltd.
Quality ASsurance dpt.

Approved By K.Kudo 2003.7.8

Checked By K.Kudo 2003.7.8.

Certified By M.Shiratori 2003.7.8

U-2549

YOSHITAKE INC.
KOMAKI PLANT
955-5, Miyamae, Irukadeshinden
Komaki, Japan 485-0084

No. 52-8113
DATE Aug. 11, 2003

CERTIFICATE OF INSPECTION

Description of Goods : GD-41 Pressure Reducing Valve (PCV-9900-659)

Manufacturing No.	:	I8
Quantity	:	1
Nominal diameter	:	20 A
Connection	:	Screwed
Fluid	:	Hot or Cold Water
		Air , N_2 , CO_2
Material		
Body	:	Cast Stainless Steel
Disc	:	FKM & Stainless Steel
Diaphragm	:	FKM & PTFE
Pressure Test (Body)		
Hydraulic test press.	:	3.0 MPa
Time	:	1 min.
Performance Inspection		
Inlet pressure	:	Max 2.0 MPa
Outlet pressure	:	0.02 ~ 0.1 MPa (0.1 MPa)
Operation	:	Good
Dimensions Inspection	:	Good
Appearance Inspection	:	Good
Inspection Date	:	Aug. 8, 2003

All-round decision

PASSED

YOSHITAKE INC.

H. Iwata

(Inspecting Group Manager).
H. Iwata

MISUZU

INSPECTION REPORT

CUSTOMER : ELLIOTT EBARA TURBO MACHINERY CORPORATION	EBARA SER. NO. : R021570804
ARTICLE : LUBE OIL CONSOLE UNIT	ITEM NO. : CT-9901/TC-9901
ITEM : RELIEF VALVE	SERIAL NO. : U-2549
DRAWING NO. : ER021570804／902 (K1-01692)	INSPECTION DATE : 30th OCT. 2003

CUSTOMER : LG ENGINEERING & CONSTRUCTION CORP.

FINAL USER : TURKISH PETROLEUM REFINERIES CORP.

PROJECT : TUPRAS IZMIR REFINERY DHP PROJECT

JOB. NO. : 7020

SERVICE : RECYCLE GAS COMPRESSOR

ITEM NO. PSV-9900-651A
PSV-9900-651B
PSV-9900-669A
PSV-9900-669B
PSV-9900-668

ELLIOTT EBARA GROUP ☐ Witnessed ☑ Reviewed

EETC Q.C Dept.

Certified by :

Inspected by : H. Tanaka

MISUZU Industrial Corporation

TEST REPORT OF SAFETY VALVES

FUKUI

MFG No. 310804A

TAG No. PSV-9900-651A

FUKUI SEISAKUSHO CO., LTD.
6, 1-chome, Shodai-Tajika, Hirakata, Osaka, Japan

JNO. 3H 0804

JOB.NO U-2549

SPECIFICATIONS

03J-011A

TYPE	RECP361(A)	SIZE IN/OUT	1.1/2 in / 2 in
SEAT DIAMETER	19.5 mm	THROAT DIAMETER	17.6 mm
LIFT	4.4 mm	CAPACITY (CALCULATION)	23 m^3/h
INLET CONNECTION	ANSI 300LB RF	OUTLET CONNECTION	ANSI 300LB RF
FLUID	OIL ISO VG32	RELIEVING TEMP.	62.3 ℃
SET PRESSURE	22.0 kgf/cm² G	CLOSING PRESSURE	17.6 kgf/cm² G
SPRING SET PRESSURE	22.0 kgf/cm² G	BLOWDOWN PRESSURE	4.4 kgf/cm²
BACK PRESSURE	- - - - - kgf/cm² G	COLD DIFFERENTIAL SET PRESSURE	22.0 kgf/cm² G

MATERIAL	
BODY	A216-WCB
BONNET OR YOKE	A216-WCB
DISC	SUS630
NOZZLE	SUS316
SPRING	SWOSM

TEST RESULTS

TESTING FLUID WATER

BLOW OFF PRESSURE	22.0 kgf/cm² G	CLOSING PRESSURE	17.6 kgf/cm² G
LIFT	4.4 mm	SEAT LEAKAGE TEST PRESSURE	17.6 kgf/cm² G
HYDROSTATIC TEST PRESSURE IN	49.0 kgf/cm² G		
PNEUMATIC TEST PRESSURE IN	- - - - - kgf/cm² G	OUT	6.0 kgf/cm² G

DIMENSION AND VISUAL INSPECTION……GOOD

SPRING LOAD TEST……GOOD

WE HEREBY CERTIFY THAT THE ABOVE TEST RESULTS ARE IN CONFORMITY WITH THE REQUIREMENTS.

APPROVED BY SUPERINTENDENT M. Yamagimoto

APPROVED BY CUSTOMER'S INSPECTOR

DATE OF TEST

JUL. 4.2003

No. 0033

TEST REPORT OF SAFETY VALVES

FUKUI

MFG No. 310804B

TAG No. PSV-9900-651B

FUKUI SEISAKUSHO CO.,LTD.
6,1-chome, Shodai-Tajika, Hirakata, Osaka, Japan

JNO. 3H 0804

JOB.NO U-2549

SPECIFICATIONS

03J-011A

TYPE	RECP361(A)	SIZE IN/OUT	1.1/2 in / 2 in
SEAT DIAMETER	19.5 mm	THROAT DIAMETER	17.6 mm
LIFT	4.4 mm	CAPACITY (CALCULATION)	23 m³/h
INLET CONNECTION	ANSI 300LB RF	OUTLET CONNECTION	ANSI 300LB RF
FLUID	OIL ISO VG32	RELIEVING TEMP.	62.3 ℃
SET PRESSURE	22.0 kgf/cm² G	CLOSING PRESSURE	17.6 kgf/cm² G
SPRING SET PRESSURE	22.0 kgf/cm² G	BLOWDOWN PRESSURE	4.4 kgf/cm²
BACK PRESSURE	- - - - - kgf/cm² G	COLD DIFFERENTIAL SET PRESSURE	22.0 kgf/cm² G

MATERIAL	
BODY	A216-WCB
BONNET OR YOKE	A216-WCB
DISC	SUS630
NOZZLE	SUS316
SPRING	SWOSM

TEST RESULTS

TESTING FLUID WATER

BLOW OFF PRESSURE	22.0 kgf/cm² G	CLOSING PRESSURE	17.6 kgf/cm² G
LIFT	4.4 mm	SEAT LEAKAGE TEST PRESSURE	17.6 kgf/cm² G

HYDROSTATIC TEST PRESSURE IN 49.0 kgf/cm² G

PNEUMATIC TEST PRESSURE IN - - - - - kgf/cm² G OUT 6.0 kgf/cm² G

DIMENSION AND VISUAL INSPECTION·····GOOD

SPRING LOAD TEST·····GOOD

WE HEREBY CERTIFY THAT THE ABOVE TEST RESULTS ARE IN CONFORMITY WITH THE REQUIREMENTS.

APPROVED BY SUPERINTENDENT M. Yamagimoto

APPROVED BY CUSTOMER'S INSPECTOR

DATE OF TEST JUL. 4.2003

TEST REPORT OF SAFETY VALVES

FUKUI

MFG No. 311381

TAG No. PSV-9900-669A

FUKUI SEISAKUSHO CO.,LTD.
6,1-chome,Shodai-Tajika,Hirakata,Osaka,Japan

JNO. 3H 1381

JOB.NO U-2549

SPECIFICATIONS

03J-056A

TYPE	RG2167-MS(A)	SIZE IN/OUT	1/2 in / 3/4 in
SEAT DIAMETER	8.2 mm	THROAT DIAMETER	7 mm
LIFT	1.8 mm	CAPACITY (CALCULATION)	2178 kg/h
INLET CONNECTION	NPT M	OUTLET CONNECTION	NPT FM
FLUID	COOLING WATER	RELIEVING TEMP.	179 ℃
SET PRESSURE	9.0 kgf/cm² G	CLOSING PRESSURE	7.2 kgf/cm² G
SPRING SET PRESSURE	9.0 kgf/cm² G	BLOWDOWN PRESSURE	1.8 kgf/cm²
BACK PRESSURE	- - - - - kgf/cm² G	COLD DIFFERENTIAL SET PRESSURE	9.0 kgf/cm² G

MATERIAL		
	BODY	A351-CF8
	BONNET OR YOKE	- - -
	DISC	SUS304
	NOZZLE	SUS304
	SPRING	SUS304

TEST RESULTS

TESTING FLUID AIR

BLOW OFF PRESSURE	9.0 kgf/cm² G	CLOSING PRESSURE	7.2 kgf/cm² G
LIFT	1.8 mm	SEAT LEAKAGE TEST PRESSURE	7.2 kgf/cm² G
HYDROSTATIC TEST PRESSURE IN	20.0 kgf/cm² G		
PNEUMATIC TEST PRESSURE IN	- - - - - kgf/cm² G	OUT	6.0 kgf/cm² G

DIMENSION AND VISUAL INSPECTION·····GOOD

SPRING LOAD TEST·····GOOD

WE HEREBY CERTIFY THAT THE ABOVE TEST RESULTS ARE IN CONFORMITY WITH THE REQUIREMENTS.

APPROVED BY SUPERINTENDENT M. Yamagimoto

APPROVED BY CUSTOMER'S INSPECTOR

DATE OF TEST

AUG.20.2003

No. 0033

TEST REPORT OF SAFETY VALVES

FUKUI

MFG No. 311382

TAG No. PSV-9900-669B

FUKUI SEISAKUSHO CO.,LTD.
6,1-chome, Shodai-Tajika, Hirakata, Osaka, Japan

JNO. 3H 1382

JOB.NO U-2549

SPECIFICATIONS

03J-056A

TYPE	RG2167-MS(A)	SIZE IN/OUT	1/2 in / 3/4 in
SEAT DIAMETER	8.2 mm	THROAT DIAMETER	7 mm
LIFT	1.8 mm	CAPACITY (CALCULATION)	2178 kg/h
INLET CONNECTION	NPT M	OUTLET CONNECTION	NPT FM
FLUID	COOLING WATER	RELIEVING TEMP.	179 ℃
SET PRESSURE	9.0 kgf/cm² G	CLOSING PRESSURE	7.2 kgf/cm² G
SPRING SET PRESSURE	9.0 kgf/cm² G	BLOWDOWN PRESSURE	1.8 kgf/cm²
BACK PRESSURE	- - - - - kgf/cm² G	COLD DIFFERENTIAL SET PRESSURE	9.0 kgf/cm² G

MATERIAL	
BODY	A351-CF8
BONNET OR YOKE	- - -
DISC	SUS304
NOZZLE	SUS304
SPRING	SUS304

TEST RESULTS

TESTING FLUID AIR

BLOW OFF PRESSURE	9.0 kgf/cm² G	CLOSING PRESSURE	7.2 kgf/cm² G
LIFT	1.8 mm	SEAT LEAKAGE TEST PRESSURE	7.2 kgf/cm² G

HYDROSTATIC TEST PRESSURE IN 20.0 kgf/cm² G

PNEUMATIC TEST PRESSURE IN - - - - - kgf/cm² G OUT 6.0 kgf/cm² G

DIMENSION AND VISUAL INSPECTION·····GOOD

SPRING LOAD TEST·····GOOD

WE HEREBY CERTIFY THAT THE ABOVE TEST RESULTS ARE IN CONFORMITY WITH THE REQUIREMENTS.

APPROVED BY SUPERINTENDENT M. Yamagimoto

APPROVED BY CUSTOMER'S INSPECTOR

DATE OF TEST AUG.20.2003

No. 0033

TEST REPORT OF SAFETY VALVES

FUKUI

MFG No. 311383

TAG No. PSV-9900-668

FUKUI SEISAKUSHO CO.,LTD.
6,1-chome,Shodai-Tajika,Hirakata,Osaka,Japan

JNO. 3H 1383

JOB.NO U-2549

SPECIFICATIONS

03J-056A

TYPE	RG2167-MS(A)	SIZE IN/OUT	1/2 in / 3/4 in
SEAT DIAMETER	8.2 mm	THROAT DIAMETER	7 mm
LIFT	1.8 mm	CAPACITY (CALCULATION)	2178 kg/h
INLET CONNECTION	NPT M	OUTLET CONNECTION	NPT FM
FLUID	COOLING WATER	RELIEVING TEMP.	179 ℃
SET PRESSURE	9.0 kgf/cm² G	CLOSING PRESSURE	7.2 kgf/cm² G
SPRING SET PRESSURE	9.0 kgf/cm² G	BLOWDOWN PRESSURE	1.8 kgf/cm²
BACK PRESSURE	- - - - - kgf/cm² G	COLD DIFFERENTIAL SET PRESSURE	9.0 kgf/cm² G

MATERIAL		
	BODY	A351-CF8
	BONNET OR YOKE	- - -
	DISC	SUS304
	NOZZLE	SUS304
	SPRING	SUS304

TEST RESULTS

TESTING FLUID AIR

BLOW OFF PRESSURE	9.0 kgf/cm² G	CLOSING PRESSURE	7.2 kgf/cm² G
LIFT	1.8 mm	SEAT LEAKAGE TEST PRESSURE	7.2 kgf/cm² G
HYDROSTATIC TEST PRESSURE IN	20.0 kgf/cm² G		
PNEUMATIC TEST PRESSURE IN	- - - - - kgf/cm² G	OUT	6.0 kgf/cm² G
DIMENSION AND VISUAL INSPECTION·····GOOD		SPRING LOAD TEST·····GOOD	

WE HEREBY CERTIFY THAT THE ABOVE TEST RESULTS ARE IN CONFORMITY WITH THE REQUIREMENTS.

APPROVED BY SUPERINTENDENT M. Yamagimoto

APPROVED BY CUSTOMER'S INSPECTOR

DATE OF TEST AUG.20.2003

MISUZU

INSPECTION REPORT

CUSTOMER : ELLIOTT EBARA TURBO MACHINERY CORPORATION	EBARA SER. NO. : R021570802
ARTICLE : DRY GAS SEAL CONSOLE UNIT	ITEM NO. : CT-9901
ITEM : PIPING	SERIAL NO. : U-2581
DRAWING NO. : ER021570801/901 (K2-03126)	INSPECTION DATE : 4th Nov. 2003

CUSTOMER : LG ENGINEERING & CONSTRUCTION CORP.

FINAL USER : TURKISH PETROLEUM REFINERIES CORP.

PROJECT : TUPRAS IZMIR REFINERY DHP PROJECT

JOB. NO. : 7020

SERVICE : RECYCLE GAS COMPRESSOR

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed

EETC Q.C Dept

Certified by :

Inspected by : H. Tanaka

MISUZU Industrial Corporation

MISUZU

INSPECTION REPORT

CUSTOMER :
ELLIOTT- EBARA TURBOMACHINERY CORPORATION

ARTICLE :
DRY GAS SEAL CONSOLE UNIT

PARTS NAME :
PIPING

INSPECTION ITEM :
MATERIAL IDENTIFICATION LIST

EBARA SER. NO. :
R021570802

ITEM NO. :

SERIAL NO. :
U-2581

INSPECTION DATE :
4th Nov. 2003

NAME	MATERIAL	SIZE	HEAT No.
PIPE	A312TP304-S	1" × SCH80	V20088
		3/4" × SCH80	V00893
		1/2" × SCH80	V00157
	A53 GR.B	1" × SCH80	11104
		3/4" × SCH80	2-45418

Certified by : H. Tanaka

Inspected by :

MISUZU Industrial Corporation

CUSTOMER:

SUPPLIER: MAKII STAINLESS

KIND OF MATERIAL:

SEAMLESS STAINLESS STEEL PIPE

ASTM A312-99 TP304/304L& ORDER SPEC.

MILL CERTIFICATE

KOBE SPECIAL TUBE CO.,LTD.

CHOFU-KITA PLANT

13-1, CHOFU-MINATOMACHI, SHIMONOSEKI

YAMAGUCHI-PREF. JAPAN

DATE OF ISSUE : MAY 09, 2002

CERTIFICATE NO. : 020509-0005-01/01

ORDER NO. :

SUPPLIER CODE : 092

SECTION CODE : ADA

REFERENCE NO. : 2A44519

CONTRACT NO.: S50420801

SIZE : 33.4X4.55X6000

BUNDLE NO. : N01-01 - N01-04

Mfg. No. Product No.	Lot No.	Heat No.	Quantity No. of Pieces	Mass	Total Lengths	Tension Test *1	*2	0.2% Y.S.	T.S.	E.	Hardness Test		Grain Size
Unit Designated			PCS	kg				KSI		%	Method:		*3
Specification		Min.						30	75	35			
		Max.											
S96765	001	V20088	67	1313		F	2"	39	84	66			
	002	V20088	34	666		F	2"	41	86	64			
		TOTAL	101	1979									

Flattening Test	GOOD	Eddy Current Test	
Flaring Test		Ultrasonic Test	
Measurement & Surface	GOOD	Penetrant Test	
Corrosion Test			
Microscopic Test			
Hydrostatic Test	2500 PSI	GOOD	

Notes

* 1 : Type of Test piece
Full Section —(F)
Strip Section —(S)

* 2 : Gauge Length
50mm—(50), 2"—(2")
5.65√S—(S)

* 3 : Austenite Grain Size —(A)
Ferrite Grain Size —(F)

* 4 : Heat Analysis —(L)
Product Analysis —(C)

The product is able to be identified with Mfg. No. (Product No.-Lot No.), written in this certificate.

SOLUTION HEAT TREATMENT :2012°F X 5.0 MIN. / W.Q.

Chemical Composition (%)

Heat No.	C ×100	Si ×100	Mn ×100	P ×1000	S ×1000	Ni ×100	Cr ×100	Mo ×100							*4
Specification Min.						800	1800								
Specification Max.	3.5	75	200	40	30	1100	2000								
V20088	1.9	31	181	31	8	913	1835								L

Remarks

021251

U-2581G

SURVEYOR TO

IT IS HEREWITH CERTIFIED THAT THE ABOVE MATERIALS ARE SATISFACTORY IN COMPLIANCE WITH THE REQUIREMENTS SPECIFIED IN THE CONTRACT.

K. Wada

MANAGER OF QUALITY SYSTEM SECTION.

3

CUSTOMER:

SUPPLIER: MAKII STAINLESS
KIND OF MATERIAL :
SEAMLESS STAINLESS STEEL PIPE

ASTM A312-95A TP304

MILL CERTIFICATE

KOBE SPECIAL TUBE CO.,LTD.
CHOFU-KITA PLANT
13-1, CHOFU-MINATOMACHI, SHIMONOSEKI
YAMAGUCHI-PREF, JAPAN

DATE OF ISSUE : MAR. 15. 2001
CERTIFICATE NO. : 10315-907-01/01
ORDER NO. :

SUPPLIER CODE : 092
SECTION CODE : ADA
REFERENCE NO. : OBM5108

CONTRACT NO.: S50122101 SIZE : 26.7X3.91X6000

Mfg. No. Product No.	Lot No.	Heat No.	Quantity No. of Pieces	Mass	Total Lengths	Tension Test *1	*2	0.2% Y. S.	T. S.	E.	Hardness Test		Grain Size
Unit Designated			PCS	kg				KSI		%	Method:		*3
Specification		Min.						30	75	35			
		Max.											
S76178	001	V00893	100	1330		F	2"	39	89	70			
	002	V00893	36	479		F	2"	40	90	69			
	003	V00893	63	838		F	2"	41	90	68			
		TOTAL	199	2647									

Flattening Test	GOOD	Eddy Current Test	
Flaring Test		Ultrasonic Test	
Measurement & Surface	GOOD	Penetrant Test	
Corrosion Test			
Microscopic Test			
Hydrostatic Test	2500 PSI	GOOD	

Notes
* 1. Type of Test piece
Full Section →(F)
Strip Section →(S)
* 2. Gauge Length
50mm→(50), 2" →(2")
$5.65\sqrt{S}$ →(S)
* 3. Austenite Grain Size →(A)
Ferrite Grain Size →(F)
* 4. Heat Analysis →(L)
Product Analysis →(C)

The product is able to be identified with Mfg. No. (Product No.-Lot No.), written in this certificate.

SOLUTION HEAT TREATMENT : 2012°F X 4.7 MIN. / W.Q.

Chemical Composition (%)

Heat No.	C ×100	Si ×100	Mn ×100	P ×1000	S ×1000	Ni ×100	Cr ×100	Mo ×100							*4
Specification Min.						800	1800								
Specification Max.	8	75	200	40	30	1100	2000								
V00893	5	45	183	28	2	867	1855								L

Remarks

021251
U-2581G

SURVEYOR TO

IT IS HEREWITH CERTIFIED THAT THE ABOVE MATERIALS ARE SATISFACTORY IN COMPLIANCE WITH THE REQUIREMENTS SPECIFIED IN THE CONTRACT.

MANAGER OF QUALITY SYSTEM SECTION.

CUSTOMER :

SUPPLIER : MAKII STAINLESS

KIND OF MATERIAL :

SEAMLESS STAINLESS STEEL PIPE

ASTM A312 TP304

MILL CERTIFICATE

KOBE STEEL, LTD.

CHOFU-KITA PLANT
13-1,CHOFU-MINATOMACHI,SHIMONOSEKI
YAMAGUCHI-PREF.,JAPAN

DATE OF ISSUE : APR. 9, 1990
CERTIFICATE NO. : 00409-023-01/01
ORDER NO. :
SUPPLIER CODE : 092
SECTION CODE : AOD
REFERENCE NO. : 9B90360

CONTRACT NO. : S50Y91001 SIZE : 21.34X3.73X6096 (1/2" X SCH80S)

Mfg. No. Product No.	Lot No.	Heat No.	Case No. Bundle No.	Quantity No. of Pieces	Weights	Total Lengths	Tension Test *1	*2	0.2% Y.S.	1% Y.S.	T.S.	E.	Hardness Test *3		Impact Test *4		Grain Size	Flattening Test	GOOD
Unit Designated				pcs	kg				KSI		KSI	%					*6	Flaring Test	
Specification	Min.								30		75	35			*5	Min. Min.		Bending Test	
	Max.														AV. Min.	AV. Min.		Flange Test	
S76227	001	V00157		105	1050		F2"		39		86	63						Reverse Bend Test	
							F2"		41		86	63						Corrosion Test	
																		Sandmark Test	
																		Microscopic Test	
																		Eddy Current Test	
																		Ultrasonic Test	
																		Measurement & Surface	GOOD
																		Liquid Penetrant Test	
																		Hydrostatic Test	PSI 2500 GOOD
																		Air Leak Test	

Heat No.	Chemical Composition (%) C ×100	Si ×100	Mn ×100	P ×1000	S ×1000	Cu ×100	Ni ×100	Cr ×100	Mo ×100	Ti ×100				*7
Specification Min.							800	1800						
Specification Max.	8	75	200	40	30		1100	2000						
V00157	4	43	185	28	5		876	1856						L

Remarks

SOLUTION HEAT TREATMENT :
2012°F X 4.5 MIN. / W.Q.

021251

U-2581G

The product is able to be identified with Mfg.No. (Product No.-Lot No.) written in the certificate.

Notes.

*1: Type of Test piece
Full Section →(F)
Strip Section →(S)
*2: Gauge Length
50mm→(50), 2" →(2")
5.65/S→(S)
*3: Method
RB→(B), HRB→(R), HRC→(C)
HV→(V), HS→(S)
*4: Temperature
°C→(C), °F→(F)
*5: Type of Specimen
S=U-notch
10×10mm→(1), 10×7.5mm→(7)
10×5mm→(3), 10×2.5mm→(4)
3=U-notch
10×10mm→(5), 10×7.5mm→(6)
10×5mm→(7), 10×2.5mm→(8)
2=U-notch
10×10mm→(A), 10×7.5mm→(B)
10×5mm→(C), 10×2.5mm→(D)
2=V-notch
10×10mm→(E), 10×7.5mm→(F)
10×5mm→(G), 10×2.5mm→(H)
*6: Austenite Grain Size →(A)
Ferrite Grain Size →(F)
*7: Heat Analysis →(L)
Product Analysis →(C)

SURVEYOR TO

IT IS HEREWITH CERTIFIED THAT THE ABOVE MATERIALS ARE SATISFACTORY IN COMPLIANCE WITH THE REQUIREMENTS SPECIFIED IN THE CONTRACT.

K, Kida

MANAGER OF QUALITY SYSTEM SECTION.

021 252
25819

検査証明書
INSPECTION CERTIFICATE

NKK 日本鋼管株式会社 NKK CORPORATION

本社：〒100-8202東京都千代田区丸の内1丁目1番2号
Head Office: 1-1-2, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8202 JAPAN

需要家 Purchaser : SAKAE KOKAN CO., LTD.

需要家管理番号 Purchaser's Order No. :

注文者 Trading Co. : NKK TRADING INC.

注文者照合番号 Reference No. : 314 002016AA

品名 Commodity & 規格 Specification : HOT FINISHED SEAMLESS STEEL PIPE API 5L B / ASTM A53 B PLAIN END

証明書番号 Certificate No. : A D3114-01 CONTINUED

日付 Date : 1999-04-19

船番/工事番号 Ship's No. / Construction No. :

製造番号 Production No. : D3114

契約番号 Contract No. : TMI0411

寸法 Size: 1NDXSCH80X5500 (M: INCH)

枝番 Item No.	長さ Length M(MM)		本数 Number of Pieces	延長さ Total Length / 質量 Mass	鋼番 Heat No.	#2	C ×100	Si ×100	Mn ×100	P ×1000	S ×1000	Cu ×100	Ni ×100	Cr ×100	Mo ×100	V ×100	#3	降伏点 Y.S	引張強さ T.S	伸び El. #5	硬度試験 Hardness Test	
					Spec. 下限 Min.												FS	241N	419N	26.5		
					Spec. 上限 Max.	L	27		115	30	30	40	40	40	15	8						
						P	27		115	30	30	40	40	40	15	8						
004	5,500		175	3,115KGS	11104	L	21	19	75	21	4	1	3	4	0	0	FS	367N	522N	43.5		101304
					"	P	22	19	74	22	4	1	3	4	0	1						
		TOTAL	175	3,115KGS	"	P	22	19	74	22	4	1	3	4	0	1						
					SPEC.			*1 X100														
					MAX.	L		100														
					MAX.	P		100														
					11104	L		8														
					"	P		9														

外観・寸法 Visual & Dimension	水圧試験 Hydrostatic Test P	非破壊検査 N.D.E.	曲げ試験 Bending Test	へん平試験 Flattening Test	押しひろげ試験 Flaring Test	溶接部延性試験 Weld Ductility Test	被覆試験 Coating Test	メッキ試験 Galvanized Test
GOOD	GOOD 850		GOOD					

*1=CU+MO+V+CR+NI

注記・Note

#1 MM: mm FN: ft-in
FT: ft

#2 L: 溶鋼分析 Ladle Analysis
P: 製品分析 Product Analysis

#4 K: kgf/mm²
KS: ksi
MP: MPa
N: N/mm²

#3 試験片 Test Specimen
JL: JIS4号(縦) -JIS No4
JT: JIS4号(横) -JIS No4
SL: JIS5号(縦) -JIS No5
ST: JIS5号(横) -JIS No5
11: JIS11号 -JIS No11
12: JIS12号(縦) -JIS No12
FS: 管状試験片 -Full Section
LW: 溶接部縦 -Longitudinal in Weld
TW: 溶接部横 -Transverse in Weld

RL: 丸棒試験片(縦) -Round Specimen(Longitudinal)
RT: 丸棒試験片(横) -Round Specimen(Transversal)
S1: 帯状試験片(縦) -Strip Specimen(Longitudinal)-Width 1/2 in.
S2: 帯状試験片(縦) -Strip Specimen(Longitudinal)-Width 3/4 in.
S3: 帯状試験片(縦) -Strip Specimen(Longitudinal)-Width 1 1/2 in.
S4: 帯状試験片(縦) -Strip Specimen(Longitudinal)-Width 1 in.
S5: 帯状試験片(横) -Strip Specimen(Transversal) -Width 1 1/2 in.
S5: 帯状試験片(縦) -Strip Specimen(Longitudinal)

#5 YR: 降伏比 -Yield Ratio
RA: 絞り -Reduction of Area

#6 K: kgf/cm² N: N/mm²
P: psi B: bar
KP: KPa A: atm
MP: MPa

上記製品は検査の結果指定の規格に合格していることを証明いたします。

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND ALSO WITH THE REQUIREMENTS CALLED FOR BY THE ABOVE ORDER.

京浜製鉄所：〒210-0855神奈川県川崎市川崎区南渡田町1番1号 KEIHIN WORKS: 1-1, MINAMIWATARIDA-CHO, KAWASAKI 210-0855 JAPAN

H. Furukawa

京浜製鉄所品質保証室長
Manager of Quality Assurance Sec.
KEIHIN WORKS

鋼管検査証明書
INSPECTION CERTIFICATE

川崎製鉄株式会社
KAWASAKI STEEL CORPORATION
知多製造所
CHITA WORKS
愛知県半田市川崎町1丁目1番地 〒475-8611
1, Kawasaki-cho 1-chome, Handa-City, Aichi Pref. 475-8611 Japan

証明書番号（送状番号）
CERTIFICATE NO. (INVOICE NO.): NL0230 (45-5879)
需要家発注NO.
ORDER NO. : 63608-04,08-030
契約番号
CONTRACT NO.: 2295-63608-04 (861 1)
注文者
SHIPPER : カワテツ ショウジ"
納入仕様書番号
M.P.S NO. : N960
需要家
CUSTOMER : サカエコウカン
品名
COMMODITY SEAMLESS STEEL PIPE
規格
SPECIFICATION : API5LB/ASTMA53B
日付
DATE : 1998-12- 2
寸法
SIZE : NB3/4" X SCH80 X 6000
員数
QUANTITY : 235
質量
MASS : 3,102 Kg
延べ長さ
TOTAL LENGTH :

製造番号 MFG.NO.	製鋼番号 HEAT NO.	化学成分 CHEMICAL COMPOSITION (%) C (×100)	Si (×100)	Mn	P (×1000)	S (×1000)	Cu (×100)	Ni (×100)	Cr (×100)	Mo	Al (×1000)	Ti (×1000)	V (×1000)	Nb	N (×10000)	Ceq. (×100)	RES (×100)	引張試験 TENSILE TEST 降伏点又は耐力 YP or YS (KSI)	引張強さ T.S (KSI)	引張強さ(溶接部) T.S (IN WELD) (KSI)	伸び E.L (%)	降伏比 Y.R	衝撃試験 IMPACT TEST 吸収エネルギー IMPACT VALUE (EACH / AVE.)	延性破面率(%) SHEAR FRACTURE AREA (EACH / AVE.)	硬さ試験 HARDNESS TEST
		採取方向 DIRECTION = L, GL = 2"																					採取方向 DIRECTION = ( )		
		H max.	27		115	30	30	40	40	40	15			80				100								SPEC.
		H min.																								max.
		P max.																								min.
		P min.																					EACH / AVE.	EACH / AVE.		
		max.																								
		min.																350	600		26.5					
N3056-01 (166)	2-45418	H	21	20	55	17	7	<1	1	3	<1			2				4		49.3	71.9		48.2			
N3056-02 (69)	2-45419	H	22	20	50	17	7	<1	1	3	<1			2				4		54.1	73.5		48.4			

外観・寸法検査 VISUAL&DIMENSION	水圧試験 HYDROSTATIC TEST	へん平試験 FLATTENING TEST	曲げ試験 BEND TEST	押しひろげ試験 FLARING TEST	つば出し試験 FLANGE TEST	縦圧試験 CRUSH TEST	展開試験 REVERSE FLATTENING TEST	めっき試験 GALVANIZED TEST	溶接部延性試験 WELD DUCTILITY TEST	ドリフト試験 DRIFT TEST	非破壊検査 N. D. E.	塗覆装試験 COATING TEST
GOOD	850PSI GOOD		GOOD								ET:GOOD	

NAZUTE 5J05

備考 REMARKS: RES=CU+NI+CR+MO+V

注記 Notes
H…Heat analysis とりべ分析
P…Product analysis 製品分析
L…Longitudinal 縦方向
T…Transverse 横方向
Ceq…Carbon equivalent 炭素当量
A……G.L=5.65 $\sqrt{A}$

上記注文品は御指定の規格または仕様に従って製造され、その要求事項を満足していることを証明します。
WE HEREBY CERTIFY THAT THE MATERIALS DESCRIBED HEREIN HAVE BEEN MANUFACTURED, INSPECTED AND TESTED IN ACCORDANCE WITH THE CUSTOMER'S SPECIFICATION(S), AND THAT THEY SATISFY THE REQUIREMENTS.

田上俊久
CHIEF INSPECTOR

JP02

放射線透過検査報告書
RadioGraphic Inspection Report

日付
Date Oct, 14, 2003

注文主
Customer MISUZU SANGYO CO.,LTD

新光検査 株式会社

製修番号 *Works No.*	工事名称または製品名 *Works Name or Articles*	検査技術者 *Engineer*	資格 *Licence No.*
U－2581	BUFFER GAS UNIT	中西 広明	NDI-RT3 No.0061512

図面番号 *Drawing No.*	検査施工日 *Inspection Date*	適用規格 *Application Standard*
S3-22117	14th, Oct, 2003	ANSI B31.3

材質 *Material*	母材の厚さ *M.M. thickness*	検査施工場所 *Inspection Place*
A312TP304	5.1 mm	SHINKO KENSA(HIMEJI)

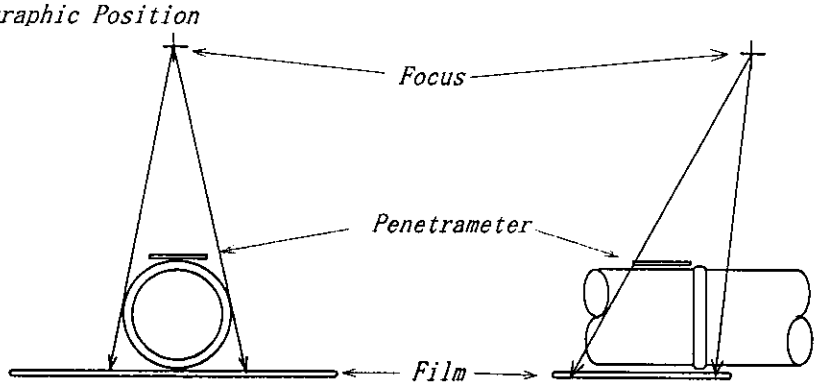
検査条件 *Inspection Condition*

放射線装置名 *Equipment*	焦点寸法 *Measure of Focus*	電圧 *Volt*	電流 *Current*
理学製 RF250EGS-Ⅱ	2.0×2.0mm	220 KVP	5 mA

距離 *Distance*	露出時間 *Time*	透過度計 *Penetrameter*	階調計 *Contrastmeter*
600 mm	1 min	No.15	――――

フイルムの種類 *Kind of Film*	増感紙 *Screen*	現像 *Develop of Film*	フイルム枚数 *Sheet of Film*
Fuji #100	Pb0.03	20℃ 5min	2 Sheets

撮影位置の略図 *Sketch of Radiographic Position*　　(撮影配置)　　単位：mm



判定基準
Acceptance Standard : *ANSI B31.3 Para 341.3.2A*

検査結果
Result of Inspection : *Write on Another Sheets*

新光検査 株式会社

MISUZU Industrial Corporation

放射線透過試験記録

RadioGraphic Examination Record

図面番号 DWG. No.	フィルム番号 Film Mark	管径 Pipe Size	日付 Date	きずの種類 Type of Flaw	きずの分類 Class	判定 Evaluation
S3-22117	No. 1-A	40A×5.1T	10/14	N.D	1	Accept
S3-22117	-B	40A×5.1T	10/14	N.D	1	Accept
	－以下余白－					

欠陥種別 Type of Defect	N.D:無欠陥(Non Defect) C:クラック(Crack) P:パイプ(Pipe) I.P:溶込不足(Incomplete Penetration) L.F:融合不良(Luck of Fusion) S.I:スラグ巻き込み(Slag Inclusion) B.H:ブローホール(Blow Hole) T:タングステン巻き込み(Tungsten Inclusion)

新光検査 株式会社

MISUZU Industrial Corporation

MISUZU

INSPECTION REPORT

CUSTOMER : ELLIOTT- EBARA TURBOMACHINERY CORPORATION

EBARA SER. NO. : R021570802

ARTICLE : DRY GAS SEAL CONSOLE UNIT

ITEM NO. : CT-9901

PARTS NAME : PIPING

SERIAL NO. : U-2581

INSPECTION ITEM : HYDROSTATIC PRESSURE TEST

INSPECTION DATE : 22nd Oct. 2003

TEST PRESSURE :	Primary Seal Gas Supply Line	145.5 kg/cm^2 G.
	Refference Gas Connection Line	168.0 kg/cm^2 G.
	Separation Gas Supply Line	15.8 kg/cm^2 G.
	Primary Vent Line	109.1 kg/cm^2 G.
	Instrument Air Line	15.0 kg/cm^2 G.
	Primary Vent Line	5.3 kg/cm^2 G.

HOLDING TIME : 30 Minutes

LIQUID : FRESH WATER

AMBIENT TEMPERATURE : 21 ℃

MATERIAL : A312TP304,A53GR.B

TEST RESULT : ACCEPTABLE (NO LEAKAGE)

REMARKS :

Certified by : H. Tanaka

Inspected by :

MISUZU Industrial Corporation

MISUZU

INSPECTION REPORT

CUSTOMER :
ELLIOTT- EBARA TURBOMACHINERY CORPORATION

ARTICLE :
DRY GAS SEAL CONSOLE UNIT

PARTS NAME :
PIPING

INSPECTION ITEM :
PNUMATIC PRESSURE TEST

EBARA SER. NO. :
R021570802

ITEM NO. :
CT-9901

SERIAL NO. :
U-2581

INSPECTION DATE :
5th Nov. 2003

TEST PRESSURE :	Primary Seal Gas Supply Line	97.0 kg/cm^2 G.
	Refference Gas Connection Line	112.0 kg/cm^2 G.
	Separation Gas Supply Line	10.5 kg/cm^2 G.
	Primary Vent LIne	72.7 kg/cm^2 G.
	Instrument Air Line	10.0 kg/cm^2 G.
	Primary Vent Line	3.5 kg/cm^2 G.

HOLDING TIME : 30 Minutes

GAS : N 2 GAS

AMBIENT TEMPERATURE : 20 ℃

MATERIAL : A312TP304,A53GR.B

TEST RESULT : ACCEPTABLE (NO LEAKAGE)

REMARKS :

Certified by : H. Tanaka

Inspected by :

MISUZU Industrial Corporation

MISUZU

INSPECTION REPORT

CUSTOMER : ELLIOTT EBARA TURBO MACHINERY CORPORATION	EBARA SER. NO. : R021570802
ARTICLE : DRY GAS SEAL CONSOLE UNIT	ITEM NO. : CT-9901
ITEM : CONTROL VALVE	SERIAL NO. : U-2581
DRAWING NO. : ER021570801／901 (K2-03126)	INSPECTION DATE : 4th Nov. 2003

CUSTOMER : LG ENGINEERING & CONSTRUCTION CORP.

FINAL USER : TURKISH PETROLEUM REFINERIES CORP.

PROJECT : TUPRAS IZMIR REFINERY DHP PROJECT

JOB. NO. : 7020

SERVICE : RECYCLE GAS COMPRESSOR

TAG NO. PDCV-9900-621
PDV-9900-623

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed

EETC Q.C Dept.

Certified by :

Inspected by : H. Tanaka

MISUZU Industrial Corporation

TEST REPORT
CONTROL VALVE U-7581

Masoneilan

Customer: MISUZU INDUSTRIAL CORPORATION
Item No. 001
Serial No. CG37A1181- 1
Tag No. : PDCV-9900-621
Quantity 1

Model No.	535C-50	Body Size & Rating	1"*ANSI 300RF
Body Material	ASTM A351 Gr-CF8M		

TEST AND INSPECTION RESULT

					Result
Specification & Appearance Inspection	Result: ☑ACCEPT.				
Body Hydrostatic Test	Water Pressure :	78	kgf/cm²	3 min.	☑ACCEPT.
Body S/A Hydrostatic Test	Water Pressure :	-	kgf/cm²	- min.	—
Body S/A Pneumatic Test	Air Pressure :	27	kgf/cm²	10 min.	☑ACCEPT.
Actuator Pneumatic Test (Upper&Lower)	Air Pressure :	5.0	kgf/cm²	3 min.	☑ACCEPT.
	(Air Pressure)	14	kgf/cm²		
Air Piping Pneumatic Test	Air Pressure :	-	kgf/cm²	- min.	—
Seat Leakage Test				Allow.: -	—
	- :	-	kgf/cm²	Actual: -	

Dimension Inspection		Face To Face(mm)	
	Specified	197.0 ±1.5	☑ACCEPT.
	Actual	197.2	

Calibration Test	Valve Action	Press. Increase to : Valve Close Press. Fail Position: Valve Open	☑ACCEPT.
	Accessories	Positioner : —	—
		Hand Wheel : —	—
		Solenoid Valve : Energized : — Deenergized : —	—
		Lock Test : —	—
		Limit Switch : Close Position × — Open Position × —	—
	Stroking time	Spec. Open→Close: — Actual Open→Close: - sec. Close→Open: — Close→Open: - sec.	—
	Test Standard: Set = 4 kgf/cm²	Stroke (mm) 0 ⟷ 2.0 Allow. Press. (kgf/cm²) - ⟷ Min. 1.46 Openning (kgf/cm²) 4.00 → 3.09 Closing (kgf/cm²) 4.43 ← 3.40 Hys. (Allow. 1.20kgf/cm²) 0.43 0.31	☑ACCEPT.

B: E5812 BN/BH: E5216 P: - S: -	Date Tested	Tested By	Approved By	Customer's Inspector
	Sep.17.2003	H. Akasawa	SEP. 19. 2003	

U-2581 ASSEMBLY TEST REPORT 14

Messers: MISUZU INDUSTRIAL CORPORATION

Plant: TUPRAS IZMIR REFINERY DHP PROJECT NF Job No.: 031993-01

Tag No.: ~~PDCV~~ PDV-9900-623 Type & Size: 657 (40)HPS 1"

Item No.: 1 (NF 101) Body Rating & Material:

Serial No.: J150429 ANSI 1500 RTJ CF8M

TEST RESULTS

Test Item		Test Press. (kg/cm2)	Keep Time (Min.)	Allow Leak	Actual Leak	Result
Hydro. Test	Shell	379.7	10	0	0	GOOD
	Ass'y	253.1	10	0	0	GOOD
Seat Leak Test		3.5	1	10 L/h	0 L/h	GOOD
Actuator air Test	Press. T.	3.0	5	0	0	GOOD
	Leak T.	1.6	5	0	0	GOOD
Dimension Inspect.		—	—	—	—	GOOD
Visual Inspect.		—	—	—	—	GOOD

Operation Test	Signal	0 %	25 %	50 %	75 %	100%	
	(kg/cm2)	1.0	0.8	0.6	0.4	0.2	
	St'd	0 mm	4.75	9.50	14.25	19.00	GOOD
	Open	0 mm	4.50	9.50	14.35	19.15	
	Close	0 mm	4.60	9.55	14.40	19.10	

Max. Travel	St'd	19 mm	Actual	20.10 mm	GOOD

Material Certificate No.: Body/ 5107702 Bonnet/ 15535

■ This component meets the requirements of NACE MR-01-75.

Nippon Fisher Co.,Ltd.
Quality Assurance Section

Approved By K. Kudo 2003.9.25

Checked By K. Kudo 2003.9.25

Certified By M. Murakami 2003.9.25

Inspected by

Form Q-1008(b) Nippon Fisher Co.,Ltd.

材料試験成績表
TEST CERTIFICATE

注文番号 Order No. R021570803
材質 Material ASTM A217 Gr. WC6
機名 Unit No. SRV-5DF
受注先 Messrs Elliott Ebara Turbomachinary Corporation 殿

No. 1357
試験日 Date Mar. 29, 2003

三菱製鋼株式会社 MITSUBISHI STEEL MFG. CO., LTD.

チャージ Charge No.	品名・図面番号 Name of Articles · Drawing No.	数量 Q'ty	規格 Spec	化学成分 Chemical Composition (%) C	Si	Mn	P	S	Cu※	Ni※	Cr	Mo	W※
				.05-.20	max. .60	.50-.80	max. .04	max. .045	max. .50	max. .50	1.00-1.50	.45-.65	max. .10
F7998	T&T VALVE CASING · ES-8651061	1		.12	.54	.67	.003	.003	.02	.03	1.29	.55	tr
	ベンケーシング												

チャージ Charge No.	試験片 Test Specimen 標点距離 G.L. mm	直径 Dia. mm	引張試験 Tension Test 降伏点 Yielding Point N/mm²	引張強さ Tensile Strength N/mm²	伸び Elongation %	絞り Reduction of Area %	曲げ試験 Bend Test 半径 I.R. mm	角度 Angle °	衝撃試験 Impact Test シャルピー Charpy at ℃ kgf·m/cm² J	硬さ Hardness Test ブリネル Brinell HB
	50	12.5	min. 275	485-655	min. 20	min. 35	—	—	—	—
F7998	〃	〃	391	542	27	61				

R021570803
SRV-5
Item No.; CT-9901
T&T Valve
Part Name; Valve Body

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed
EETC Q.C Dept. T. Tobe

熱処理 Heat Treatment

Normalizing (焼準) 950℃ 3Hr A.C.
Tempering (焼戻) 720℃ 4Hr A.C.
Stress Reliving (応力除去焼鈍) 690℃ 4Hr F.C.

備考 Remarks

※ The total of these elements does not exceed 1.00, the maximum specification requirements.

F7998 : 0.05

VT : Good
DT : Good

INSPECTION TEAM
☐WITNESSED ☑REVIEWED
LG E&C Nov. 13, 2003

・電気炉製鋼法にて製造
made by the electric furnace process
・試験機No. Test machine No.
アムスラー Amsler 7769
ブリネル Brinell 14949
シャルピー Charpy 695

検定年月日 Calibrated in April

御立会者 Surveyor

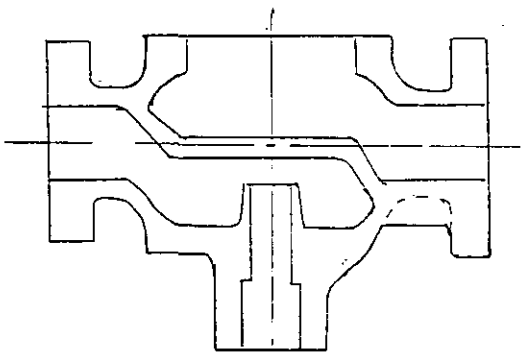
品質保証課長 Manager of Quality Assurance Section

Total 5 sheets
1

MAGNETIC PARTICLE INSPECTION RECORD
磁粉探傷検査記録

Customer 注文主	Elliot Ebara Turbomachinery Corporation殿	Examined Date 検査日	Mar. 29, 2003
Order No 工事番号	R02/570803	Unit No. 機名	SRV-5DF
Article 品名	T&T VALVE CASING ベンケーシング	Surface Condition 表面状況	As Cast & Rough Machining 鋳放及び荒加工
Drawing No 図番	ES-865-1061	Method of Inspection 検査方法	(WM) DM RM (CM) E W (P) B C F
Material 材質	ASTM A217 GR WC6	Magnefization Curent 磁化電流	(DC) (Amp) AC 1200 Amp. turn
Charge No. 溶解番号	F7998	Pole or Prod Distance 極間の距離	180 ~ 200 mm
Quantity 数量	1 P	Demagnetization 脱磁	Yes 実施済 (No 未実施)
Note WM: Wet Method 湿式法　DM: Dry Method 乾式法 RM: Residual Method 残留法　CM: Continuas Method 連続法 E : End Contact Method 通電法　P : Prod Method プロッド法 M : Magnetic Pole Method 極間法　C : Coil Method コイル法		Type of Equipment 探傷装置の形式	EB-3A
		Magnetic Particle 磁粉 Type 種類	(Flourescent 蛍光) Visible 非蛍光
		Density 濃度	15 g/l
		Field Indicator 標準試験片	JIS 0565 A1- 30/100

Inspection Portion
検査位置 : All Surface
全面



R02/570803
SRV-5DF
Item No.; CT-9901
T&T Valve
Part Name: Valve Body

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed
EETC Q.C Dept.

LG E&C INSPECTION TEAM ☐WITNESSED ☑REVIEWED Nov. 13, 2003

Result 結果	Good	(Acceptance Standard : 適用規格 :	[EBARA STD.] SPS- 1002 - 20)

Surveyor	Q.A Manager	Q.A Engineer	Inspector
		—	M. Iwashita

注文番号
Order No. R021570803

材質 ASTM A217
Material Gr. WC6

材料試験成績表
TEST CERTIFICATE

No. 1358

試験日
Date Mar. 29, 2003

機名
Unit No. SRV-5DF

受注先
Messrs Elliott Ebara Turbomachinary Corporation 殿

三菱製鋼株式会社
MITSUBISHI STEEL MFG. CO., LTD.

チャージ Charge No.	品名・図面番号 Name of Articles・Drawing No.	元素 Elements / 数量 Q'ty	規格 Spec	化学成分 Chemical Composition (%) C	Si	Mn	P	S	Cu※	Ni※	Cr	Mo	W※
				.05–.20	max. .60	.50–.80	max. .04	max. .045	max. .50	max. .50	1.00–1.50	.45–.65	max. .10
F7982	T&T COVER ・ ES-8652071	1		.12	.41	.58	.003	.002	.01	.03	1.23	.55	0r
	カバー												

チャージ Charge No.	試験片 Test Specimen 標点距離 G. L. mm	直径 Dia. mm	引張試験 Tension Test 降伏点 Yielding Point N/mm²	引張強さ Tensile Strength N/mm²	伸び Elongation %	絞り Reduction of Area %	曲げ試験 Bend Test 半径 I. R. mm	角度 Angle °	衝撃試験 Impact Test シャルピー Charpy at ℃ kgf·m/cm² J	硬さ Hardness Test ブリネル Brinell HB
	50	12.5	min. 275	485–655	min. 20	min. 35	—	—	—	—
F7982	〃	〃	383	539	27	59				

R021570803
SRV-5DF
Item No.: CT-9901
T&T Valve
Part Name: Valve Cover

ELLIOTT ☐Witnessed ☑Reviewed
EETC Q.C Dept.

熱処理 Heat Treatment

Normalizing (焼準) 950℃ 3Hr A.C.

Tempering (焼戻) 720℃ 4Hr A.C.

Stress Reliving (応力除去焼鈍) 690℃ 4Hr F.C.

備考 Remarks

※ The total of these elements does not exceed 1.00, the maximum specification requirements.

F7982 : 0.04

VT : Good
DT : Good

INSPECTION TEAM
☐WITNESSED ☑REVIEWED
Nov. 13 2003
LG E&C

・電気炉製鋼法にて製造
made by the electric furnace process

・試験機No. Test machine No.
アムスラー Amsler 7769
ブリネル Brinell H4949
シャルピー Charpy 695

検定年月日 Calibrated in April

御立会者 Surveyor

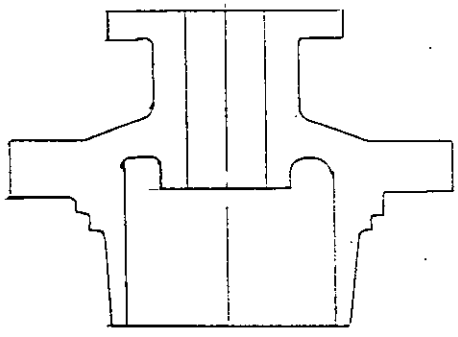
品質保証課長 Manager of Quality Assurance Section

MAGNETIC PARTICLE INSPECTION RECORD

磁粉探傷検査記録

Customer 注文主	Elliot Ebara Turbomachinery Corporation殿	Examined Date 検査日	Mar. 29, 2003
Order No 工事番号	R021570803	Unit No. 機名	SRV-5DF
Article 品名	COVER カバー	Surface Condition 表面状況	As Cast & Rough Machining 鋳放 及び 荒加工
Drawing No 図番	ES-865207T1	Method of Inspection 検査方法	(WM) DM RM (CM) E M (P) B C F
Material 材質	ASTM A217 GR. WC6	Magnetization Curent 磁化電流	(DC) (Amp) AC 1200 Amp. turn
Charge No. 溶解番号	F7982	Pole or Prod Distance 極間の距離	180 ~ 200 mm
Quantity 数量	1 P	Demagnetization 脱磁	Yes (No) 実施済 未実施
Note WM: Wet Method 湿式法　DM: Dry Method 乾式法 RM: Residual Method 残留法　CM: Continuas Method 連続法 E : End Contact Method 通電法　P : Prod Method プロッド法 M : Magnetic Pole Method 極間法　C : Coil Method コイル法		Type of Equipment 探傷装置の形式	EB-3A
		Magnetic Particle 磁粉 Type 種類	(Flourescent) Visible 蛍光 非蛍光
		Density 濃度	1.5 g/l
		Field Indicator 標準試験片	JIS 0565 A1- 30/100

Inspection Portion
検査位置 : All Surface
全面



R021570803
SRV-5DF
Item No.; CT-9901
TRT Valve
Part Name; Valve Cover

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed

EETC Q.C Dept.

INSPECTION TEAM
☐WITNESSED ☑REVIEWED
LG E&C Nov. 13, 2003

Result 結果	Good	(Acceptance Standard : (適用規格 :	[EBARA STD.] SPS-1002-20)

Surveyor	Q.A Manager	Q.A Engineer	Inspector
	K. Koike	—	M. Iwashita

TEST RESULTS SHEET

UNIT NAME: TRIP AND THROTTLE VALVE

HYDROSTATIC TEST RECORD

NO. 03-05

MESSRS. ELLIOTT EBARA CORPORATION

DATE: MAY-26-2003

ORDER NO. R021570803

PRODUCTION NO. SRV-5DF

PARTS	QUANTITY	TEST PRESS	HOLD TIME	TEST RESULT
6"X6"-600# T&T CASING & COVER	1 SET	W.T.P. 86 kg/cm²G	30 MIN.	GOOD
~~VALVE SEAT~~	~~1~~	~~A.T.P. 10 kg/cm²G~~	~~10 MIN.~~	~~4CC GOOD~~
~~OIL CYLINDER~~	~~1 SET~~	~~O.T.P. 10 kg/cm²G~~	~~30 MIN.~~	~~GOOD~~

DESCRIPTION

RESET OIL PRESS : 3.5 kg/cm²G

TRIP OIL PRESS : 2.8 kg/cm²G

ORIFICE : φ4

R021570803
SRV-5DF
Item No.; CT-9901
T&T Valve
Part Name; Valve Body

LG E&C INSPECTION TEAM ☐WITNESSED ☑REVIEWED NOV. 13, 2003

ELLIOTT EBARA GROUP ☐Witnessed ☑Reviewed

EETC Q.C Dept.

1-16-1 CHOME, SHIROKANE, MINATO-KU, TOKYO,
HAGIWARA VALVE KOGYO CO., LTD.
TEL. TOKYO(03)3443-8451 FAX. TOKYO(03)3443-8456

CHECK	CHIEF
H.Uchida	

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