THIS SPECIFICATION SHALL BE FOLLOWED BY THE VENDOR IN ADDITION TO THE REQUIREMENTS SPECIFIED IN SPECIFICATION NO. TCE.M4-904 TITLED "SHOP INSPECTION AND TEST PROCEDURE".

1.0 QUALITY ASSURANCE/QUALITY CONTROL PROGRAMME

1.1 Only critical inspection stages have been indicated in the enclosed "Minimum Inspection Requirements" documents. This is however, not intended to form a comprehensive programme as it is the VENDOR's responsibility to draw up and implement such programme duly approved by the PURCHASER. The detailed Quality Plans for manufacturing and field activities should be drawn up by the BIDDERS, separately in the format attached and shall be submitted to PURCHASER at the time of submitting his offer.

2.0 All the sub-vendors proposed by the VENDOR for procurement of major bought out item including castings, forgings, semi-finished and finished components/equipment, shall be subject to PURCHASER'sreview/clearance for systems and packages.

3.0 A consolidated list of all major equipment including boughtouts like pumps, valves, fans etc.shall be submitted by the VENDOR along with the offer for PURCHASER's review/comments.

4.0 The PURCHASER reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the VENDOR's or their SUB-VENDOR's quality management and control activities. The VENDOR shall provide all necessary assistance to enable the PURCHASER to carry out such audit & surveillance.

5.0 The VENDOR shall undertake an inspection and testing programme during manufacture in his works and that of his sub-contractor to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identification and acceptability of all materials, parts and equipment. He shall carry out all tests/inspections required to establish that the items/equipment conform to requirements of contract specification and the relevant codes/standards specified therein, in addition to carrying out tests as per the approved Quality Plan.

6.0 VENDOR shall use calibrated instruments for testing, with traceability to NATIONAL /INTERNATIONAL levels. If not the PURCHASER/CONSULTANT will not witness the tests till the same is organised.

7.0 Only latest edition of the codes/standards and specifications shall be used for materials and testing. The latest edition is reckoned with the date of contract awarded.

MINIMUM INSPECTION REQUIREMENTS FOR EXPANSION PIECES/HOPPERS

				INSPN CATEGORY
1.	RAW MATERIAL	a) Material Tests	Certificates Review	C
2.	INPROCESS CONTROL			
	a) Welding	a) Welding Procedure and Welder's Performance & Qualifications		C
		b) Kerosene leak test on all weld joints		A
3.	FINAL INSPECTION	Dimensional Inspection during Trial Assembly		A

NOTES:

(A) INSPN CATEGORY :

A - WITNESSED BY TCE/PURCHASER

B - WITNESSED BY TCE/PURCHASER'S DISCRETION

C - CERTIFICATES REVIEW BY TCE/PURCHASER

(B) ACCEPTANCE NORMS:

(1) MATERIALS : As per applicable material specifications

(2) WELDING : As per AWS D1.1

MINIMUM INSPECTION REQUIREMENTS FOR SAFETY VALVES & SAFETY RELIEF VALVES

				INSPN CATEGORY
1.	RAW MATERIAL	a) Material Tests	Certificates Review	C
		b) Springs :		
		i) MT	100%	A
		ii) Hardness check	10%	
		iii) Performance test	10%	
		b) Inlet neck and seat bushing	100% UT	A
		c) Nozzle	100% RT/UT	A
		d) Body and Bonnet of Cast Carbon and Stainless Steel valves (600 rating and above), Ferritic Alloy Steel valves (All ratings)	100% RT	A
		e) Body and Bonnet of forged Steel valves (1500 rating and above)	100% UT	A
		f) Body and Bonnet of all valves	100% MT (PT for non-magnetic matls.)	A
		g) Stem	100% UT if dia > 50mm	C
2.	INPROCESS CONTROL			
	a) Machining	Seat Face	100% PT	A
	b) Hydrotest	Base assembly		A
	c) Welding	Butt Welds	100% RT	A
3.	FINAL INSPECTION	a) Seat test		A
		b) Set Pressure test		A
		c) Back Pr. test (For S.R. Valves)		A
		d) Dimensional inspection		A

MINIMUM INSPECTION REQUIREMENTS FOR SAFETY VALVES & SAFETY RELIEF VALVES

NOTES:

(A) INSPN CATEGORY :

A - WITNESSED BY TCE/PURCHASER

B - WITNESSED BY TCE/PURCHASER'S DISCRETION

C - CERTIFICATES REVIEW BY TCE/PURCHASER

(B) ACCEPTANCE NORMS:

(1) MATERIALS	: As per applicable material specifications
(2) WELDING	: As per ASME Section-IX/IBR
(3) NON DESTRUCTIVE TESTING	: As per ASME Section-V/Section-VIII Div. 1 ANSI B 16.34 requirements/IBR
(4) VALVE LEAKAGE	: As per ASME section I/API 598/IBR

(C) PT - LIQUID PENETRANT TESTING

MT - MAGNETIC PARTICLE TESTING

UT - ULTRASONIC TESTING

RT - RADIOGRAPHIC TESTING

					INSPN CATEGORY
1.	MATERIALS:	BODY & BONNET	a) MTC Verification		C
			b) Identification & Correlation		B
			c) Visual Inspection		B
		Stem	a) 100% UT for shaft dia > 50mm		C
2.	IN PROCESS INPECTION:				
	Forged Steel Components		1500 class & above :		
			UT of body & bonnet	100%	C
			600 class & above :		
			MT of body & bonnet including machined surfaces for magnetic materials, PT for non-magnetic materials	100%	C
			For all class of valves :		
			a) Welding Procedure Qualification & Welder Performance Qualification Tests		C
			b) Procedure Qualification for hard facing		C
			c) Hardness test on seat & back seat	100%	C
			d) PT on stellited seats & machined surfaces		C
			a) UT/RT of full penetration welds		A
			b) MT of Fillet Joints		B

			INSPN CATEGORY
3.	FINAL INSPECTION FOR ALL TYPES OF VALVES:	a) Hydro test of body	A
		b) Hydro test of back seat	A
	NOTE : Check valves to be subjected to hydro test of body; hydro test of seat at 100% and 25% of seat test pressure.	c) Hydro test of seat	A
		d) Pneumatic test of seat	A
		e) Performance test of valve with actuator	A
		f) Dimensional inspection	A

NOTES:

(A) INSPN CATEGORY :

A - WITNESSED BY TCE/PURCHASER

B - WITNESSED BY TCE/PURCHASER'S DISCRETION

C - CERTIFICATES REVIEW BY TCE/PURCHASER

(B) ACCEPTANCE NORMS:

(1) MATERIALS	: As per applicable material specifications
(2) WELDING	: As per ASME Section-IX
(3) NON DESTRUCTIVE TESTING	: As per ASME Section -V/ ANSI B 16.34 requirements
(4) VALVE LEAKAGE	: As per IS 6157

(C) PT - LIQUID PENETRANT TESTING

MT - MAGNETIC PARTICLE TESTING

UT - ULTRASONIC TESTING

RT - RADIOGRAPHIC TESTING

				INSPN CATEGORY
1.0	Raw Materials :			
	Rubber	:	a)Chemical Properties	C
			b) Mechanical Properties	A
			c) Bond Test (Adhesion)	A
	Fibre Glass Reinforced Plastic	:	a) Glass Percentage	A
			b) Tensile Strength	A
			c) Flexural Strength	A
			d) Bond Test	A
			e) Lap Shear Strength of laminate	A
2.0	In Process Inspection	:	a) Surface finish check of the equipment/component prior to Rubber Lining	B
3.0	Final Inspection			
	a) Rubber Lining	:	a) Hardness Test	A
			b) Holiday Test (Spark test)	A
			c) Thickness Measurement	A
	b) FRP Lining	:	a) Barcol Hardness Test	A
			b) Thickness Measurement	A
			c) Holiday Test (Spark test)	A

NOTES:

(A) INSPN CATEGORY :

A - WITNESSED BY TCE/PURCHASER
B - WITNESSED BY TCE/PURCHASER'S DISCRETION
C - CERTIFICATES REVIEW BY TCE/PURCHASER

(B) ACCEPTANCE NORMS :

(1) MATERIALS : IS 4682 - PART I, ASTM D638 & BS 4994
(2) HARDNESS TEST : IS 4682 - PART I & BS 2782
(3) HOLIDAY TEST : IS 4682 - PART I
(4) THICKNESS MEASUREMENT : IS 4682 - PART I

				INSPN CATEGORY
1.0	RAW MATERIAL			
	CASTINGS & FORGINGS	BODY, BONNET, STEM, BALL, PLUG	a) Chemical & Mechanical Properties	C
			b) MT of castings & forgings for magnetic materials, PT for non-magnetic materials - 100%	C
			c) UT of stem if Dia > 50 mm - 100%	C
			d) RT of body & bonnet for ferritic alloy steel valves - 100%	A
		DIAPHRAGM/SEATS	a) Hardness test	C
		DIAPHRAGM	a) Endurance test	B
2.0	IN PROCESS INSPECTION			
	WELDING		a) Welder's performance qualification/welding procedure qualification	C
	BODY, BONNET, STEM, PLUG AFTER MACHINING		a) PT on machined area -100%	B
			b) Hardness test on trim -100%	C
3.0	FINAL INSPECTION			
	FOR ALL VALVES		a) Hydro test of Body	A
	NOTE : Check valves to be subjected to hydro test of body; hydro test of seat at 100% and 25% of seat test pressure.		b) Hydro test of seat	A
	FOR GATE & GLOBE VALVES		a) Hydro test of back seat	A
			b) Pneumatic test of seat	A
	FOR BALL, PLUG & DIAPHRAGM VALVES		a) Pneumatic test of seat	A

		INSPN CATEGORY
4.0 FINAL INSPECTION		
FOR STEAM TRAPS / STRAINERS, FITTERS	a) Hydro test	A
FOR VALVES & SPECIALITIES	a) Operation & performance test	A
	b) Dimensional inspection	A

NOTES:

(A) INSPN CATEGORY:

A - WITNESSED BY TCE/PURCHASER

B - WITNESSED BY TCE/PURCHASER'S DISCRETION

C - CERTIFICATES REVIEW BY TCE/PURCHASER

(B) ACCEPTANCE NORMS:

(1) MATERIALS : As per applicable material specifications

(2) WELDING : As per ASME Section-IX

(3) NON DESTRUCTVE TESTING : As per ASME Section-V/ASME B 16.34 requirements

(4) VALVE LEAKAGE TESTS : As per IS 6157

(C) PT - LIQUID PENETRANT TESTING

MT - MAGNETIC PARTICLE TESTING

UT - ULTRASONIC TESTING

RT - RADIOGRAPHIC TESTING

				INSPN CATEGORY
A	MATERIALS			
	PIPES	a) Visual inspection		A
		b) Material test certificates verification		C
		c) Hydrostatic test at shop/mills		C
	Tests for Wrought and Cast fittings :	Refer TCE.M4-185-43 (Minimum inspection requirements for fittings)		
	Tests for tie rods and hangers (VLH & CLH) :	Refer TCE.M4-185-03 (Minimum inspection requirements for hangers and tie rods)		
B.	INPROCESS INSP.			
	1. WELDING	a) Welding procedure qualification as per ASME SEC IX		B
		b) Welders' and Welding Operators' Performance qualification as per ASME SEC IX		B
	2. BENDS (COLD/HOT FORMED)	a) Heat treatment chart review as per ASME B 31.1		C
		b) Bend Area	100% MT	A
	3. WELD ENDS	a) Weld end preparation	Visual inspection	B
		b) Weld ends	10% MT/PT	A
		c) Butt weld ends	Dimensional inspection	B
		d) Pre heating as per Cl.131 of ASME B 31.1	Record review	C
		e) Root run	100% MT/PT	B

			INSPN CATEGORY
3. HEAT TREATMENT	a) Stress relief/post weld heat treatment as per Cl.132 of ASME B 31.1	Record review	C
4. FINISHED WELD	a) Piping with design pressure >17.6 kg/cm^2 (g) or design temp. > 218^{o}C :		
	Butt welds > 100 NB	100% RT & 100% MT/PT	A
	Butt welds ≤ 100 NB	10% RT & 10% MT/PT	A
	Alloy Steel Nozzle & Branch welds for size > 100 NB	100% RT/UT & 100% MT/PT	A
	Carbon Steel Nozzle & Branch welds for size > 100 NB & thk > 19mm	100% RT/UT & 100% MT/PT	A
	All other attachment welds	100% MT/PT	A
	Removal of weld defect by grinding/machining	100% MT/PT	A
	Weld repair	Same testing method used earlier	A
	b) Piping with design temp. ≤ 218^{o}C and Design Pressure ≤ 17.6 kg/cm^2(g) ; Piping under Vacuum (except systems under c)		
	Butt welds > 100 NB	10% RT & 10% MT/PT	A
	All other attachment welds	10 % MT/PT	A
	Removal of weld defect by grinding/machining	100% MT/PT	A
	Weld repair	Same testing method used earlier	A
	c) Cooling Water Line, Instrument Air, Service Air & Miscellaneous Water Lines	Visual inspection of welds	A

MINIMUM INSPECTION REQUIREMENTS FOR POWER PLANT PIPING (NON IBR)

Also refer Specification Nos. TCE.M4-185-03, TCE.M4-185-43

			INSPN CATEGORY
C.	FINAL INSPECTION	a) Dimensional inspection	A
		b) Hydro test of completed welds (at shop/site)	A

NOTES:

(1) INSPECTION CATEGORY:

A - WITNESSED BY TCE/PURCHASER

B - WITNESSED BY TCE/PURCHASER'S DISCRETION

C - CERTIFICATES REVIEW BY TCE/PURCHASER

(2) ACCEPTANCE NORMS:

(a) MATERIALS : As per applicable material specifications

(b) WELDING : As per ASME Section-IX

(c) NON DESTRUCTIVE TESTING : As per ASME Section-V/ASME B 31.1

(3) PT - LIQUID PENETRANT TESTING

MT - MAGNETIC PARTICLE TESTING

UT - ULTRASONIC TESTING

RT - RADIOGRAPHIC TESTING

VLH - VARIABLE LOAD HANGERS

CLH - CONSTANT LOAD HANGERS

MINIMUM INSPECTION REQUIREMENTS FOR BLOWERS

				INSPN CATEGORY
1.	RAW MATERIAL			
	Plate materials, Blades	Mechanical properties, Chemical composition		C
	Shaft forgings	Mechanical Properties, Chemical Composition		C
		UT for shafts > 50mm	100% UT	C
	Blades	Profile, Dimensional check		A
	Impeller	HT chart Review		C
2.	WELDING REQUIREMENT	a) All welds (Butt and Fillet welds)	100% MT/PT	C
3.	FINAL INSPECTION	a) Static & Dynamic balancing of Rotor Assembly		A
		b) Leak Test		A
		c) Performance test including noise level, vibration level, natural frequency checks		A

NOTES:

(A) INSPN CATEGORY :

A - WITNESSED BY TCE/PURCHASER

B - WITNESSED BY TCE/PURCHASER'S DISCRETION

C - CERTIFICATES REVIEW BY TCE/PURCHASER

(B) ACCEPTANCE NORMS:

(1) MATERIALS	: As per applicable material specifications
(2) WELDING	: As per ASME Section-IX
(3) NON DESTRUCTIVE TESTING	: As per ASME Section-V
(4) DYNAMIC BALANCING	: As per ISO 1940/VDI 2060 Gr. 6.3
(5) NOISE LEVEL	: Shall not exceed 85 dB at a distance of 1 metre
(6) VIBRATION LEVEL	: VDI 2056 'Good' Zone

(C) PT - LIQUID PENETRANT TESTING

MT - MAGNETIC PARTICLE TESTING

UT - ULTRASONIC TESTING

RT - RADIOGRAPHIC TESTING

			INSPN CATEGORY
1.0	RAW MATERIALS :		
	a) FITTINGS	1) Material Test Certificates Review	C
		2) Forged Butt Welded Fittings :	
		a) All Alloy Steel fittings (except SS fittings)	a) Product Analysis b) 100% MT — C
		b) SS fittings	100% PT — C
		c) Carbon Steel fittings	100% MT — C
		d) Tension test of fittings (Supplementary test)	Extent of testing : One sample per lot — C
		2) Forged Socket Welded Fittings :	
		a) Raw material > 50mm dia.	100% UT — C
		b) All alloy steel fittings (except SS fittings)	a) Product Analysis b) 100% MT — C
		c) SS fittings	100% PT — C
		d) All carbon steel fittings	100% MT — C
		e) Tension test of fittings (Supplementary test)	Extent of testing : One sample per lot — C
		3) Cast Fittings :	
		a) All Alloy Steel fittings	a) Product Analysis b) 100% RT, 100% MT — C

				INSPN CATEGORY
		b) Carbon Steel fittings in which any one of the following conditions exist : i) Design temp. > 218 °C ii) Steam pressure > 17.6 kg/cm^2 iii) Feed water pr. > 24.6 kg/cm^2	100% RT & 100% MT	C
		c) Carbon Steel fittings in which none of the following conditions exist : i) Design temp. > 218 °C ii) Steam pressure > 17.6 kg/cm^2 iii) Feed water pr. > 24.6 kg/cm^2	100% MT	C
		d) Tension test of fittings (Supplementary test)	Extent of testing : One sample per lot	C
2.0	FINAL INSPECTION	1) Dimensional Inspection		A
		2) IBR certification (as applicable)		C

NOTES:

(A) INSPN CATEGORY:

A - WITNESSED BY TCE/PURCHASER

B - WITNESSED BY TCE/PURCHASER'S DISCRETION

C - CERTIFICATES REVIEW BY TCE/PURCHASER

(B) ACCEPTANCE NORMS:

(1) MATERIALS : As per applicable material specifications

(2) NON DESTRUCTIVE TESTING : As per ASME Section-V

(C) PT - LIQUID PENETRANT TESTING

MT - MAGNETIC PARTICLE TESTING

UT - ULTRASONIC TESTING

RT - RADIOGRAPHIC TESTING

			INSPN CATEGORY
1.0	RAW MATERIAL		
	A) COVER, BODY & SUPPORTS	1) Visual Inspection	C
		2) Review of MTC	C
2.0	WELDING (COVER, BODY, SUPPORTS)	1) Welding Procedure qualification & welder's performance qualification tests	C
		2) 100% PT/MT	C
3.0	ASSEMBLY	1) Hydro test (Body & Cover)	A
		2) Pressure drop test across filter in clean & clogged condition	A
		3) Mesh size check	A
		4) Performance test	A
		5) In case of duplex filters, change over valves shall be subjected to leakage test	A

NOTES:

(A) INSPN CATEGORY:

A - WITNESSED BY TCE/PURCHASER

B - WITNESSED BY TCE/PURCHASER'S DISCRETION

C - CERTIFICATES REVIEW BY TCE/PURCHASER

(B) ACCEPTANCE NORMS:

(1) MATERIALS : As per applicable material specifications

(2) WELDING : As per ASME Section-IX

(3) NON DESTRUCTIVE TESTING : As per ASME Section-V / Section-VIII Div. 1 requirements

(C) PT - LIQUID PENETRANT TESTING
MT - MAGNETIC PARTICLE TESTING
UT - ULTRASONIC TESTING
RT - RADIOGRAPHIC TESTING

				INSPN CATEGORY
1.0	RAW MATERIAL :			
	a) FORGINGS, RAILS, WIRE ROPE, GEAR BOX, ROPE DRUM, MOTORS	1) Material Test Certificates		C
		2) Load Test for Hook		C
		3) Hook	100% MT/PT	A
		4) Shaft (if diameter > 50mm)	100% UT	C
		5) Gear Box	Run Test	A
		6) Motors	For motors > 30KW	
			-Type test	C
			-Routine test	A
			For motors ≤ 30KW	
			- Routine test	C
2.0	IN PROCESS CONTROL			
	a) WELDING	Welder's Performance and Welding Procedure qualification records.		B
		Inspection of welds – 10% PT		A
	b) MACHINED COMPONENTS	Gears, Pinions, Shaft, Rope drum, etc.	100% MT/PT	A
3.0	FINAL INSPECTION	1) Visual Inspection		A
		2) Dimensional Inspection		A
		3) Full load and Overload test		A
		4) Operational and Functional test		A
		5) Electrical checks		A

NOTES:

(A) INSPN CATEGORY:

A - WITNESSED BY TCE/PURCHASER

B - WITNESSED BY TCE/PURCHASER'S DISCRETION

C - CERTIFICATES REVIEW BY TCE/PURCHASER

(B) ACCEPTANCE NORMS:

(1) MATERIALS	: As per applicable material specifications
(2) WELDING	: As per AWS D 1.1
(3) NON DESTRUCTIVE TESTING	: As per ASME Section-V/ AWS D 1.1 requirements
(4) VIBRATION LEVEL	: VDI 2056 - 'Good' Zone
(5) NOISE LEVEL	: Max. 85 dB at 1.0 m distance
(6) FULL LOAD & OVER LOAD TEST	: As per IS 3938

(C) PT - LIQUID PENETRANT TESTING

MT - MAGNETIC PARTICLE TESTING

UT - ULTRASONIC TESTING

RT - RADIOGRAPHIC TESTING

MINIMUM INSPECTION REQUIREMENTS FOR ROTARY FEEDERS

		INSPN CATEGORY
1.	Raw Material :	C
	TC verification for a) Housing b) Rotor c) Shaft	
2.	N.D.T. :	C
	PT on castings - critical area and machined surfaces UT on Shaft > 50mm diameter	
3.	Bought Outs :	C
	Electric Motor	
4.	Final Inspection :	B
	Dimensional Review of manufacturing records No Load Running Test Vibration & Noise Level Seal Test	

REFERENCE DOCUMENTS :

1. Data Sheet
2. Drawings
3. Q.A.Plan

NOTES:

(A) INSPN CATEGORY:

A - WITNESSED BY TCE/PURCHASER

B - WITNESSED BY TCE/PURCHASER'S DISCRETION

C - CERTIFICATES REVIEW BY TCE/PURCHASER

SPECIFICATION NO. TCE.M4-186-01	TCE CONSULTING ENGINEERS LIMITED
	SHOP INSPECTION REQUIREMENTS UNFIRED PRESSURE VESSELS
	SECTION D27
	SHEET 1 OF 1

SERIAL NO.	DESCRIPTION	VISUAL EXAMINATION	DIMENSIONS	MATERIAL TEST CERT.	IDENTIFICATION AND CORRELATION	ULTRASONIC TEST	WELDING QUALIFICATION	FIT UP	BACKCHIP - PT	PT / MT	RADIOGRAPHY	PRODUCTION WELD COUPON TEST	OVALITY, THINNING	HEAT TREATMENT	SURFACE FINISH	HYDROSTATIC LEAK TEST	PNEUMATIC LEAK TEST	HARDNESS TEST	SPARK, ADHESION TEST	THICKNESS CHECK	OPERATION AND RUN OUT TESTS				
1	MATERIAL FOR PRESSURE PARTS, FLANGES, PADS, LUGS	D	D	C	D	D																			
2	FORMED SHELLS, HEADS	D	D							D			D	C											
3	BUTT, GROOVE WELDS ON PRESSURE PARTS, FLANGES, PADS, LIFTING LUGS	D	D			B	A/C	D	D	B	B	B													
4	FILLET WELDS ON ABOVE MATERIALS	D	D				A/C			D							D								
5	OVERLAY WELDS	D	D			D	A/C			A															
6	INTERNAL SUPPORTS WELDING IF ANY	D	D																						
7	INTERNAL FITTINGS, IF ANY	D	D																						
8	COMPLETED VESSEL	A	A											C	A	A	B								
9	MOUNTED AGITATORS, IF ANY	A	A	C	D	B	C/A			B											A				
10	LININGS, IF ANY	A																A	A	A					
11	COATINGS, IF ANY	A																		A					

LEGEND

A - WITNESSED BY TCE.

B - WITNESSED BY TCE IF REQUIREMENT IS SPECIFIED.

C - RECORDS VERIFIED BY TCE WHEREVER APPLICABLE.

D - A OR C, AT TCE'S DISCRETION WHEREVER APPLICABLE.

NOTES

1 - ALL STAGES SHALL BE CHECKED 100 % BY VENDOR AND RECORDS THEREOF SHOWN TO TCE.

2 - WITNESSING BY TCE MAY BE 100 % OR ON RANDOM SAMPLES.

3 - THIS DOCUMENT SHALL BE READ IN CONJUNCTION WITH INSPECTION REQUIREMENTS MENTIONED IN TCE. M4 - 904 AND RELEVANT TECHNICAL SPECIFICATIONS.

4 - THE PRESSURE GAUGES AND INSTRUMENTS FOR MEASURING CRITICAL PARAMETERS SHALL HAVE VALID CALIBRATION CERTIFICATE TRACEABLE TO NATIONAL LABORATORY.

ISSUE R2

SPECIFICATION NO TCE.M4-186-04																							
SERIAL NO.	DESCRIPTION	VISUAL EXAMINATION	DIMENSIONS	MATERIAL TEST CERT.	IDENTIFICATION AND CORRELATION	POURING	PT / MT	RADIOGRAPHY	ULTRASONIC TEST	HEAT TREATMENT	HARDNESS TEST	SHELL, GLAND LEAK TEST -HYDROSTATIC	SEAT, BACK SEAT LEAKTEST-HYDROSTATIC	SEAT LEAK TEST - AIR	SET POINT	DISC STRENGTH TEST	PERFORMANCE / OPERATION TESTS	TYPE TESTS	ROUTINE TESTS	ADHESION, HARDNESS, SPARK, THICKNESS	ENDURANCE (TYPE) TEST		
1	PRESSURE PARTS - MATERIALS	D		C	D	D	B	B	B	C	D	D											
2	TRIMS (SEATS, STEM, PLUG, DISC ETC.)			C			D		B		B												
3	SPRINGS			C															C^X		C		
4	DIAPHRAGM										C										D		
5	NON - METALLIC ITEMS, IF ANY			C							D												
6	ACTUATORS, POSITIONERS, IF ANY	A	A									A^Z					A	C	C				
7	FINISHED ITEMS	A	A									A	A	B			A						
8	SAFETY RELIEF VALVES - ADDITIONAL TESTS											D		A	A								
9	BUTTER FLY VALVES - ADDITIONAL TESTS															B							
10	CONTROL VALVES - ADDITIONAL TESTS																A^Y						
11	LININGS, IF ANY	A																		A			

TCE CONSULTING ENGINEERS LIMITED

SHOP INSPECTION REQUIREMENTS

VALVES-METALLIC

SECTION D28

SHEET 1 OF 1

LEGEND

A - WITNESSED BY TCE.

B - WITNESSED BY TCE IF REQUIREMENT IS SPECIFIED.

C - RECORDS VERIFIED BY TCE WHEREVER APPLICABLE.

D - A OR C, AT TCE'S DISCRETION WHEREVER APPLICABLE.

X - SCRAG TEST AND LOAD / DEFLECTION TEST.

Y - INCLUDING Cv.

Z - FOR ACTUATOR CHAMBER.

NOTES

1 - ALL STAGES SHALL BE CHECKED 100 % BY VENDOR AND RECORDS THEREOF SHOWN TO TCE.

2 - WITNESSING BY TCE MAY BE 100 % OR ON RANDOM SAMPLES.

3 - THIS DOCUMENT SHALL BE READ IN CONJUNCTION WITH INSPECTION REQUIREMENTS MENTIONED IN TCE. M4 - 904 AND RELEVANT TECHNICAL SPECIFICATIONS.

4 - THE PRESSURE GAUGES AND INSTRUMENTS FOR MEASURING CRITICAL PARAMETERS SHALL HAVE VALID CALIBRATION CERTIFICATE TRACEABLE TO NATIONAL LABORATORY.

SERIAL NO.	DESCRIPTION	VISUAL EXAMINATION	DIMENSIONS	MATERIAL TEST CERT.	IDENTIFICATION AND CORRELATION	ULTRASONIC TEST	WELDING QUALIFICATION	FIT UP	BACKCHIP-PT	PT / MT	RADIOGRAPHY	OVALITY, THINNING	HEAT TREATMENT	SURFACE FINISH	HYDROSTATIC LEAK TEST	HARDNESS TEST	SPARK, ADHESION TEST	THICKNESS CHECK	MATERIAL CHECK TEST		
A	**ORDERED ON MANUFACTURER**																				
1	PLATES / PIPES FOR FABRICATED ITEMS	D	D	C	D	D															
2	ROLLING, FORMING FOR FAB. ITEMS	D	D									D									
3	BUTT, GROOVE WELDS FOR FABRICATED ITEMS	D	D			B	C/A	D	D	B	B										
4	FINISHED ITEMS	A	A	C	A	B							C	B	B				D		
5	LININGS, IF ANY	A														A	A	A			
6	COATINGS, IF ANY	A																A			
B	**ORDERED ON DEALERS / STOCKISTS ETC.**	A	A	C	A									A	C	A^X	A^X	A^X	D		

LEGEND

A - WITNESSED BY TCE.

B - WITNESSED BY TCE IF REQUIREMENT IS SPECIFIED.

C - RECORDS VERIFIED BY TCE WHEREVER APPLICABLE.

D - A OR C, AT TCE'S DISCRETION WHEREVER APPLICABLE.

X - FOR LINED ITEMS.

ISSUE R2

NOTES

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SPECIFICATION NO.
TCE.M4-186-05

TCE CONSULTING ENGINEERS LIMITED

SHOP INSPECTION REQUIREMENTS

PIPES AND PIPE FITTINGS-METALLIC

SECTION D29

SHEET 1 OF 1

SPECIFICATION NO.
TCE.M4-186-06

TCE CONSULTING ENGINEERS LIMITED

SHOP INSPECTION REQUIREMENTS

TRAPS, STRAINERS AND FILTERS

SECTION D30

SHEET 1 OF 1

SERIAL NO.	DESCRIPTION	VISUAL EXAMINATION	DIMENSIONS	MATERIAL TEST CERT.	IDENTIFICATION AND CORRELATION	WELDING QUALIFICATION	HYDROSTATIC LEAK TEST	PERFORMANCE / OPERATION TEST	HARDNESS TEST	SPARK, ADHESION TEST	THICKNESS CHECK					
1	PRESSURE PARTS - MATERIALS			C	D											
2	FINISHED ITEM	A	A			C/A	A	D								
3	LININGS, IF ANY	A							A	A	A					

LEGEND

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ISSUE R2

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SPECIFICATION NO.
TCE.M4-186-26

TCE CONSULTING ENGINEERS LIMITED

SHOP INSPECTION REQUIREMENTS

AIR FILTERS

SECTION D31

SHEET 1 OF 1

SERIAL NUMBER	DESCRIPTION	VISUAL EXAMINATION	DIMENSIONS	MATERIAL TEST CERTIFICATE	INITIAL RESISTANCE CHARACTERISTIC TEST IN CLEAN CONDITION	DUST HOLDING CAPACITY TEST	EFFICIENCY TEST	PRESSURE DROP TEST IN SATURATED CONDITION	FILTER TO FRAME SEAL - LEAK TEST							
1	CABINET / FILTER FRAME			C												
2	FILTER MEDIUM	A	A	C												
3	DUST FOR EFFICIENCY TEST			C												
4	AIR FILTER ASSEMBLY	A	A		A^X	A	A^Y	A^X	A							

LEGEND

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C - RECORDS VERIFIED BY TCE WHEREVER APPLICABLE.

D - A OR C, AT TCE'S DISCRETION WHEREVER APPLICABLE.

X - BY PRESSURE DROP AT 40, 60, 80, 100, 120 PERCENT OR 50, 75, 100, 125 PERCENT OF RATED FLOW.

Y - COLLECTION EFFICIENCY / GRAVIMETRIC EFFICIENCY AND MICRON SIZE TEST BY DOP / METHYLENE BLUE CLOUD FOR HEPA FILTERS AND TEST DUST (FUSED ALUMINIUM OXIDE DUST) FOR PRE AND MEDIUM / FINE FILTERS - AT 100 % AND 20 % RATED FLOW.

NOTES

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SPECIFICATION NO.
TCE.M4-186-35

TCE CONSULTING ENGINEERS LIMITED

SHOP INSPECTION REQUIREMENTS
STRUCTURAL FABRICATION

SECTION D32

SHEET 1 OF 1

SERIAL NUMBERS	DESCRIPTION	VISUAL EXAMINATION	DIMENSIONS	MATERIAL TEST CERTIFICATE	IDENTIFICATION AND CORRELATION	ULTRASONIC TEST	WELDING QUALIFICATIONS	FIT UP	BACK CHIP - PT	PT / MT	RADIOGRAPHY	WELD PROFILE, UNDERCUT, OVERLAP	STRAIGHTNESS, DEFLECTION	MATCH MARKING	SURFACE FINISH	COATING THICKNES	DIP, STRIP, ADHESION TESTS		
1	STRUCTURAL MATERIALS, PLATES	D	D	C	A	B													
2	FASTENERS	A	A	C	A														
3	FLAME CUT / SHEARED EDGES									B									
4	BUTT AND GROOVE WELDS	A	A				C/A	D	D	B	B	A							
5	FILLET WELDS	A	A				C/A	D		B		A							
6	PROTOTYPE ASSEMBLED STRUCTURE	A	A									A	A^X						
7	FINAL ASSEMBLED STRUCTURES	A	A									A	A^X	A					
8	GALVANIZING (IF SPECIFIED)	A													A	A	A		
9	PAINTING (IF SPECIFIED)	A													A	A			

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C - RECORDS VERIFIED BY TCE WHEREVER APPLICABLE.

D - A OR C, AT TCE'S DISCRETION WHEREVER APPLICABLE.

X - SHALL BE CHECKED ON LEVELLED, RIGID FLOORING FOR STRAIGHTNESS / VERTICALITY / DEFLECTION / FLATNESS, CAMBER, SWEEP (FOR CURVED PORTIONS), LATERAL VARIATION BETWEEN WEB AND FLANGE, SQUARENESS OF STIFFENERS.

ISSUE R2

NOTES

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SPECIFICATION NO. TCE.M4-186-38		TCE CONSULTING ENGINEERS LIMITED																									
		SHOP INSPECTION REQUIREMENTS PNEUMATIC CONVEYOR-DENSE PHASE																									
SERIAL NO.	DESCRIPTION	VISUAL EXAMINATION	DIMENSIONS	MATERIAL TEST CERT.	IDENTIFICATION AND CORRELATION	ULTRASONIC TEST	WELDING QUALIFICATIONS	FIT UP , BACK CHIP - PT	PT / MT	RADIOGRAPHY	ALIGNMENT, RUN OUT, CLEARANCE	DYNAMIC BALANCING	SURFACE FINISH	HARDNESS TEST	LINING TESTS (THICKNESS, SPARK, ADHESION)	LEAK TEST	NO LOAD RUN TEST	PERFORMANCE / OPERATION	VIBRATION, NOISE, TEMP. RISE	LIFE CYCLE, DUST PROTECTION FOR BEARINGS	PRODUCT CERTIFICATES	TYPE TESTS	ROUTINE TESTS	CALIBRATION	PAINTING / COATING THICKNESS	SECTION D33
1	RAW MATERIALS - (a) PLATES, SHEETS, CASTINGS, STRUCTURALS, PIPES, FITTINGS, ETC.	A	A	C	A	B																				SHEET 1 OF 1
	(b) BARS, FORGINGS, ALLOY STEEL MATERIALS	A	A	C	A	B								A												
	(c) NON - METALLIC ITEMS, LININGS	A	A	C	D								A	A	A											
2	CONVEYING VESSEL / PD PUMP / DENSE PHASE UNIT	A	A	C	A	B	C/A	D		B			A			A									C	
3	FABRICATED ITEMS - SILOS, BINS, PIPING	A	A	C	A		C/A	D	B	B			A			A									C	
4	BAG FILTER	A	A	C			C/A						A			A		A	A		C					
5	VIBRATOR	A	A	C									A		B			A	A		C					
6	AIR COMPRESSOR	A	A	C								C				C		A	A		C					
7	VALVES, FILTERS	A	A	C												D					C					
8	MOTORS > 30 KW / < 30 KW	A	A	C	A																C	C	A/C			
9	INSTRUMENTS	A	A	C														D			C			D		
10	CONTROL PANEL	A	A	C														A			C	C	A			
11	METALLIC LININGS	A	A	C	D		C/A		B				A	A													
12	ASSEMBLY OF CONVEYOR	A	A								A						A	B	A		C				D	

LEGEND

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ISSUE R2

NOTES

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4 - THE PRESSURE GAUGES AND INSTRUMENTS FOR MEASURING CRITICAL PARAMETERS SHALL HAVE VALID CALIBRATION CERTIFICATE TRACEABLE TO NATIONAL LABORATORY.

1.0 GENERAL

1.1 The following terms used in this specification shall also mean to cover other terms as shown below:

OWNER - OWNER / PURCHASER / USER

CONSULTANT - CONSULTANT / ENGINEER / INSPECTION AGENCY
VENDOR - VENDOR / CONTRACTOR / FABRICATOR / SUPPLIER

SUB-VENDOR - SUB-VENDOR / SUB-CONTRACTOR /
SUB-FABRICATOR / SUB-SUPPLIER and all such agencies

1.2 The Plant and Equipment covered by this Contract shall be subjected to inspection and testing. The VENDOR shall provide all services to establish and maintain quality of workmanship in his Works and that of his SUB-VENDORS to ensure the mechanical accuracy of components, compliance with approved drawings, identification and acceptability of all materials, parts and Equipment.

1.3 For supply of systems, VENDOR shall, at the start of the 'Contract', furnish a total list of items in their scope of work. This list, giving a brief description of the item, quantity, names of probable SUB-VENDORS, and a blank column for agency for final approval of drawings / data sheets, shall be submitted for approval by CEPCC/EPCC. (The blank column shall be filled by CEPCC/EPCC.) The list shall be submitted within two weeks from the date of LOI.

1.4 For systems and major items such as pressure/load bearing items, machineries etc., the VENDOR shall furnish quality plan giving details of checks / tests to be conducted by them on material, process, sub-assembly and assembly. These shall include requirements as prescribed in the applicable specifications, codes and statutory requirements. The quality plan shall be reviewed by the OWNER / CEPCC/EPCC and the stages to be witnessed and verified shall be indicated by the OWNER /CEPCC/EPCC in the quality plan and approved.

1.5 The VENDOR shall give the CEPCC/EPCC written notice of any material being ready for testing as per format enclosed. The clear notice period shall be seven (7) days for local inspection and fifteen (15) days for outstation inspection. Such tests shall be to the VENDOR'S account except for the expenses of the CEPCC/EPCC. The CEPCC/EPCC, unless the inspection of the tests is virtually waived, shall fix a date for inspection with the VENDOR and attend such tests within fifteen (15) days of the date on which the Equipment is notified as being ready for test / inspection failing which, the VENDOR may proceed with the tests and shall forthwith forward to the CEPCC/EPCC duly certified copies of tests in triplicate. If the VENDOR fails to offer the Equipment for inspection as per the agreed date, he is liable to pay for the time and expenses for the infructuous visit of the CEPCC/EPCC.

1.6 In all cases where inspection and tests are required whether at the premises or Works of the VENDOR or of any SUB-VENDOR or at laboratory, the VENDOR, except where otherwise specified, shall provide free of charge all facilities such as labour, materials, electricity, fuel, water, stores, test bed, apparatus and instruments, laboratory tests etc. as may be required by the CEPCC/EPCC or his authorised representative to carry out effectively such tests of the Equipment in accordance with the 'Contract' and shall give facilities to the CEPCC/EPCC or to his authorised representative to accomplish testing.

1.7 The OWNER or the CEPCC/EPCC shall at all working hours have access to all parts of the VENDOR'S and his SUB-VENDOR'S factory where the items of the Plant are being prepared, for carrying out inspection activities as deemed necessary. A set of the relevant latest approved drawings with approval marking of the CEPCC/EPCC and drawings for proprietary items shall be made available by the VENDOR to the OWNER or the CEPCC/EPCC, for reference during inspection.

1.8 In the case of stage inspection hold points, the VENDOR shall proceed from one stage to another only after the component is inspected by the OWNER or his representative and written permission given to proceed further. The same procedure shall be adopted for any rectifications / repairs suggested by the OWNER or the CEPCC/EPCC.

1.9 The OWNER or the CEPCC/EPCC shall have the right to inspect any machinery, material, structures, Equipment or workmanship furnished or used by the VENDOR and may reject any which is defective or unsuitable for the use and purpose intended, or which is not in accordance with the intent of the Contract. The VENDOR, upon demand by the OWNER or the CEPCC/EPCC, shall remedy or replace at the VENDOR'S expense such defective or unsuitable items of the Plant, or the OWNER or the CEPCC/EPCC may, at the expense of the VENDOR, remedy or replace such defective or unsuitable items of the Plant.

1.10 All principal mill test reports, vendor inspection / tests reports, test certificates and test curves shall be supplied for all inspection / tests carried out including other records such as stress relieving charts, radiographic charts and other non-destructive testing records in accordance with the provisions of the Contract, duly certified by the main VENDOR. The OWNER or the CEPCC/EPCC shall reserve the right to call for certificates of origin and test certificates for all raw material and Equipment at any stage of manufacture.

1.11 The CEPCC/EPCC shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the VENDOR of any non-conformance pertaining to all or any Equipment and workmanship which in his opinion is not in accordance with the 'Contract'. The VENDOR shall give due consideration to such objections and shall either make the modifications that may be necessary to meet the said objections or shall confirm in writing to the CEPCC/EPCC giving reasons therein that no modifications are necessary to comply with the 'Contract'.

1.12 When the factory tests and documentation have been satisfactorily completed at the VENDOR'S or SUB-VENDOR'S Works, the CEPCC/EPCC shall issue acceptance note / shipping release note / certificate to this effect within fifteen (15) days after completion, but if the tests are not witnessed by the CEPCC/EPCC, the certificate or comments thereof shall be issued within fifteen (15) days of the receipt of the VENDOR'S test certificate by the CEPCC/EPCC. Failure of the CEPCC/EPCC to take such an action shall not prevent the VENDOR from proceeding with the Work. The completion of these tests or the issue of the certificates shall not bind the OWNER to accept the Equipment should it, on further tests after erection, be found not to comply with the 'Contract'.

1.13 None of the Plant and the Equipment to be furnished or used in connection with the Contract shall be despatched until shop inspection, satisfactory to the OWNER or the CEPCC/EPCC has been made. However, such shop inspection and/or certification shall not relieve the VENDOR of his responsibility for furnishing the Plant and the Equipment conforming to the requirements of the Contract nor prejudice any claim, right or privilege which the OWNER or the CEPCC/EPCC may have because of the use of defective or unsatisfactory items. Should the OWNER or the CEPCC/EPCC waive the right to inspect any item, such waiver shall not relieve the VENDOR in any way from his obligation under the Contract. In the event of the OWNER or the CEPCC/EPCC's inspection revealing poor quality of goods, the OWNER or the CEPCC/EPCC shall be at liberty to specify additional inspection procedures, if required, to ascertain the VENDOR'S compliance with the Equipment Specifications.

2.0 SUB-ORDERS

2.1 In order to facilitate the inspection of bought-out materials and Plant, the VENDOR shall submit for approval, three (3) copies of all sub-orders placed by him as soon as they are issued. Copies of any drawings referred to in the sub-order shall also be submitted, unless otherwise agreed by the OWNER or the CEPCC/EPCC.

2.2 The sub orders and drawings referred to above shall include all components which are subjected to electrical and mechanical pressure or stress when the Plant is in operation, and also auxiliaries and spares which are to be directly despatched to Site from the SUB-VENDOR'S Works.

2.3 All sub-orders of the main VENDOR and SUB-VENDORS shall clearly be marked with the main VENDOR'S name and the OWNER'S name and 'Contract' reference. They shall include the following statement:

"The Plant or the Equipment which is the subject of this order shall comply in every respect with the requirements of the CEPCC/EPCC'S technical specifications and shall be subject to inspection and tests to the satisfaction of the CEPCC/EPCC and ourselves".

2.4 For the purpose of this clause, inter-works orders shall also be treated as sub-orders. It is obligatory on the VENDOR that he advises his SUB-VENDOR of the pertinent clauses in this Specification when ordering bought-out Plant, Equipment or materials. In particular, the VENDOR shall advise very SUB-VENDOR that he is required to supply design calculations, drawings, inspection reports and test certificates strictly in accordance with this Specification and technical information for inclusion in the Instruction Manual as specified in Section-E. The SUB-VENDORS should also be reminded that they shall include with their offer all tools and appliances necessary for proper maintenance and all spare parts in accordance with Section-E of the Specification. Itemised prices of the recommended spare parts shall be submitted together with the appropriate part numbers and drawings.

2.5 Sub-ordering / sub-contracting for major items such as pressure / load bearing items, machinery etc. can be done only with the approval of the OWNER / CEPCC/EPCC.

3.0 MATERIAL TESTS

3.1 In the event of the OWNER or the CEPCC/EPCC being supplied with the certified particulars of tests which have been carried out for the VENDOR by the supplier of material, the OWNER or the CEPCC/EPCC may, at his own discretion, accept the same as proper evidence of compliance with the requirements of appropriate specifications for the materials.

3.2 The VENDOR is to provide test pieces as required by the CEPCC/EPCC to enable him to determine the quality of material supplied under the 'Contract'. If any test piece fails to comply with the requirements, the CEPCC/EPCC may reject the entire lot of material represented by the test piece.

3.3 Critical materials used in manufacture of the Equipment and construction of the Plant covered by the 'Contract' may also be subjected to one or more of the non-destructive tests (NDT) as called for in the Specification or as mutually agreed. Salvaging of material due to unacceptable defect is to be attempted by the VENDOR only after getting specific concurrence from the OWNER or the CEPCC/EPCC and according to the approved procedures.

4.0 WELDING

4.1 All welding involved in construction and fabrication of the Plant and items covered under the 'Contract' shall be carried out in accordance with procurement specifications and applicable codes.

4.2 Welding procedures and welders' qualifications shall be approved by the CEPCC/EPCC. Where applicable, welders shall be tested as detailed in codes specified for pipe welding, vessel welding and structural welding and appropriate to the corresponding weld position using test pieces of

appropriate parent metal to be used on the job. The CEPCC/EPCC shall have the right to have any welder re-tested at any time during the 'Contract'.

4.3 Recommendations of applicable codes shall be followed for non-destructive tests, wherever applicable.

4.4 Copies of all welding procedures, procedure qualification records, welders' performance qualification certificates, post-heating / stress relieving records, NDT records and other test results shall be made available upon request of the CEPCC/EPCC.

5.0 FABRICATION/INSPECTION

Fabrication / Inspection procedures for vessels, heat exchangers, pipes, tubes, valves, etc. shall be in accordance with procurement specifications, quality plan, applicable codes or any other approved equal.

6.0 TESTS AT MANUFACTURER'S WORKS

6.1 General

The tests at Works shall include electrical, mechanical and hydraulic tests in accordance with the appropriate clauses of Statutory Regulation, relevant codes and standards and approved drawings / specifications and in addition any test called for by the OWNER or the CEPCC/EPCC to ensure that the Plant being supplied fulfils the requirements of the Specifications. The VENDOR shall carry out all the shop tests and inspections specified under individual items of the Equipment in Section-D, in addition to those normally required as per codes / standards. For items not covered by any code or specifically mentioned in the Specifications, the tests are to be agreed with by the CEPCC/EPCC. If considered necessary by the OWNER or the CEPCC/EPCC, multi-part assemblies shall be fully erected and tested in the Works prior to packing and despatch to the Site.

6.2 Test Certificates

Test certificates including test records, performance curves and balancing certificates shall be supplied according to the Distribution Schedule. All the tests shall be carried out in accordance with the provisions of the 'Contract'.

All test certificates must be endorsed with sufficient information to identify the material or the Equipment to which the certificates refer, and must carry at the top right hand corner the identification of the OWNER and the 'Contract'.

6.3 Calibration

All instruments used for critical measurement such as pressure gauges for leak tests, instruments for measuring performance parameters, instruments for precision dimension measurements shall have valid calibration certificates traceable to national standards. This means that the calibrating agency

engaged by the VENDOR shall use instruments which are in turn calibrated by Government approved agencies and such an information shall be recorded in the calibration certificate issued by the calibrating agency by giving the certificate number, date and date of validity of the certificate given by the Government approved agency.

FORMAT FOR INSPECTION REQUEST FROM VENDOR

To
M/s TCE Consulting Engineers Ltd.,

Attn : Mr.
(PROJECT COORDINATOR)

Dear Sirs,

Items detailed below are ready for inspection. Please arrange inspection and confirm the date.

1. Client/ End user :
2. Project :
3. Client's order Ref. :
4. TCE's Ref. :
5. Sub-order Ref. :
6. Sub-Contractor's name & full address :
7. Place of inspection (Full address) :
8. Contact person, Phone, Fax and Telex Nos. :
9. Description of item & Qty. :
10. Billing Schedule No. :
11. Nature of inspection required :
12. Proposed date(s) :
13. Weekly holiday :

We confirm that the items have been fully inspected / tested by us, all stages of inspection as per quality plan have been done by TCE and us and all material test certificates, Q.C. records and test reports and valid calibration reports of measuring / testing instruments with traceability to national level are ready with us.

Thanking you and awaiting your confirmation,

Yours faithfully,

Note: 1. Following clear notice periods (date of receipt at TCE to date of inspection) are required:

(a) Local Inspection - 7 days
(b) Outstation Inspection - 15 days

2. Weekly Holidays for TCE - Saturday & Sunday

cc: Client
cc: Sub-Vendor

With respect to the goods covered in the enquiry specifications, the VENDOR/ CONTRACTOR shall provide to the EPCC guarantees:

1.0 OF TITLE

The VENDOR / CONTRACTOR warrants that the goods are not subject to any security interest, lien or other encumbrance.

2.0 INDEMNIFICATION AGAINST THIRD PARTY INTELLECTUAL PROPERTY RIGHTS

2.1 The Contractor shall indemnify and keep indemnified the EPCC from and against any and all claims, actions, costs, charges and expenses arising from or for infringement of Third Party Intellectual Property Rights in respect of patent rights, copyrights or other protected rights of any designs, plans, diagrams, drawings in respect of the materials, items, equipment etc. supplied by the CONTRACTOR or any of the manufacturing methods or processes adopted by the CONTRACTOR under the contract.

2.2 In the event of any claim being made or action being brought against the EPCC in respect of the matter referred to in clause 2.1 above, the CONTRACTOR shall promptly be notified thereof and he shall at his own expense, conduct all negotiations for the settlement of the same and any litigation that may arise therefrom.

2.3 In the event of any designs, drawings, plans or diagrams or any manufacturing methods or processes furnished by the CONTRACTOR constituting infringement of Third Party Intellectual Property Rights in respect of patent or any other protected rights and use thereof is restrained, the CONTRACTOR shall procure for the EPCC, at no cost to the latter, the rights to continue using the same or to the extent it is possible to replace the same so as to avoid such infringement and subject to approval by the EPCC or modify them so that they become non-infringing but such modifications shall otherwise be to the entire satisfaction of the EPCC.

2.4 The provision of this clause shall remain effective and binding upon the CONTRACTOR even after the completion, expiration or termination of the contract.

3.0 OF PERFORMANCE

The VENDOR / CONTRACTOR shall guarantee that the goods furnished by him are in full accordance with the requirements of the enquiry specifications.

4.0 OF QUALITY

4.1 The VENDOR / CONTRACTOR warrants that the goods are new and of high quality and that the goods will be free of defects in design, materials or workmanship for a period of twelve (12) months from the date of initial operation or eighteen (18) months after delivery at job site of all the goods to be supplied under the order, whichever date shall first occur unless otherwise stated elsewhere in the enquiry specifications.

4.2 If within the expiry of the above stipulated guarantee period, the subject goods or any parts thereof are found defective because of design, workmanship or materials, the VENDOR / CONTRACTOR shall at his own expense, repair or furnish and install replacement parts of design, workmanship and material approved by the EPCC. The guarantee period for replaced parts or repair work shall be the same as above.

5.0 The guarantee period shall be extended by the length of time required to make any adjustments, changes or repairs necessary to fulfil the guarantee.

6.0 The VENDOR / CONTRACTOR shall obtain similar guarantees from each one of his SUB-VENDORS / SUB-CONTRACTORS. However, the overall responsibility shall lie with the VENDOR / CONTRACTOR.

1.0 PACKING

1.1 All equipment / material shall be protected for ocean shipment, inland transport, carriage at the site and outdoor storage during transit and at the site, strictly according to the instructions given in this specification.

1.2 The VENDOR/CONTRACTOR shall be responsible for any damage to the equipment during transit due to improper and inadequate packing.

1.3 Only packages constructed out of sound material and of dimensions proportional to the size and weight of contents shall be used.

1.4 Bundled materials shall be strapped rigidly with steel band over the protective covering.

1.5 Fragile materials shall be securely braced within the containers or otherwise amply fastened and packed to prevent shifting or rattling. Soft non-hygroscopic packing materials shall be placed between the hard packing materials and the fragile equipment. Articles which do not completely fill the selected container must be cushioned, braced, fastened or blocked to prevent damage to the article itself or destruction of the container. Inner bracing or blocking must be such that the content's weight is distributed over interior surfaces rather than concentrate on one or two critical points.

1.6 Loose material, e.g bolts, nuts, etc., shall be packed in gunny bags and sealed in polythene bags with proper tagging.

1.7 Components containing glass shall be carefully covered with shock absorbing protective material such as expanded polysterene ('Thermocole').

1.8 All flanges, etc., which are prone to scratching shall be provided with either metal or wooden caps bolted in place. Metalcaps should have a minimum thickness of 3 mm and wooden caps should be made from two layers of wood, each of 10 mm thickness, nailed together with the grain of each layer located at right angles to the other.

1.9 All openings in the equipment shall be tightly covered. Plugged or capped to prevent foreign material from entering.

1.10 In the case of large and bulky equipment, the VENDOR / CONTRACTOR shall be responsible for ascertaining transport limitations and supply the equipment in the minimum number of components or sub-assemblies, within the framework of transport limitations.

1.11 Wherever necessary, proper arrangements for attaching slings for lifting shall be provided.

1.12 The contents of the packages shall be sealed in thick polythene sheets and all the inside walls of the packages shall be lined with waterproof paper to protect the equipment from damage due to dust and moisture.

1.13 All equipment shall be protected for the entire period of despatch, storage and erection, against corrosion, incidental damage due to vermin, sunlight, rain, high temperature, humid atmosphere, rough handling in transit, and storage in the open including possible delays in transit Material and equipment shipped across the sea shall be packed to withstand without damage, the effects of salt spray. All machined and plated parts shall be protected with anti-rust grease. Precautions shall be taken to protect shafts and journals where they rest on wooden or other supports likely to contain moisture. As such points, wrappings impregnated with anti-rust composition or vapour phase inhibitors shall be used. These shall have sufficient strength to resist chafing and identification due to the movement which is likely to occur in transit. The protective wrappings and impregnation shall last for a minimum period of three months.

1.14 Silica-gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.

1.15 Adequate provision of skids or pallets shall be made to keep the packages above the collecting drainage. Crates and other large containers should have drain holes in the bottom to prevent collection of water within the packing. This is especially important where the cargo itself is subject to condensation (cargo sweat).

1.16 All cases shall be provided with suitable cut-outs, closed by bolted wooden planks to facilitate inspection by customs authorities. Waterproof transparent papers shall be provided at the cutout

locations to prevent water ingress into the casing through the cut-out.

1.17 Each crate or package shall contain a packing list in a waterproof envelope. Copies of the packing list, in triplicate, shall be forwarded to the CEPCC prior to despatch. All items of material shall be clearly marked for easy identification against the packing the list.

1.18 All spare parts shall be packed and treated for long storage conditions at site.

1.19 The CEPCC / CONSULTANT may require to inspect and approve the packing before the items are despatched. However, the VENDOR / CONTRACTOR shall be entirely responsible for ensuring that the packaging is suitable for ocean shipment and such inspection will not exonerate the VENDOR / CONTRACTOR from any loss or damage due to faulty packing.

1.20 Any material found short inside the intact packing cases shall be supplied by the VENDOR / CONTRACTOR at no extra cost to the OWNER / EPCC.

1.21 All packing cover and packing material shall become the property of the BIDDER except that for spares and tools & tackles which are required to be deposited with EPCC stores at site.

2.0 MARKING

2.1 All packages shall be clearly, legibly and durably marked with uniform block letters (Preferably with waterproof paint) on at least three sides with :

a) Destination address as communicated.

b) Contract Number

c) Dimensions

d) Net and gross weights

e) Sign showing ‘side up’

f) Sign showing ‘fragile’ marks in case of delicate

g) Sign showing slinging and sling position

h) Any handling and packing instructions, if considered necessary

i) Identification mark relating them to the appropriate shipping documents

j) In case of spare parts, each spare part shall be clearly marked and labelled on the outside of its packing with its description and catalogue / part number

2.2 ERECTION MARKS

All equipments comprising multipart assemblies, e.g. steel frame works, piping, etc., shall be marked with identifying numbers and / or letters corresponding to those of the approved drawings or material lists. These erection marks shall be clearly readable.

Colour banding to an approved code shall be employed to identify members of similar shape or type but of different strengths or grades.

2.3 The contents of the package shall be punched on no-corrosive metal plate and nailed to the package on a prominently visible place. If the number of terms in the package is too many, a typed list in transparent waterproof bag shall be kept inside a galvanised steel prominently visible location.

3.0 TRANSPORT

3.1 No material shall be despatched without prior consent of the OWNER / EPCC or his representative.

3.2 The VENDOR / CONTRACTOR shall intimate the CEPCC / CONSULTANT in writing the probable date when the equipment shall be ready for despatch, at least within seven (7) days for domestic supply in advance. Copies of the packing list shall also be sent along with the advance intimation.

3.3 In the event of the VENDOR / CONTRACTOR proposing to deliver the equipment in component or sub-assembly form, he shall furnish full particulars of the quantity and approximate size of each

item. All sub-assemblies shall be match-marked to facilitate assembly at site.

4.0 FOR ELECTRICAL EQUIPMENT ONLY

4.1 Transformers rated 2000 KVA and less shall be shipped with oil. Transformers rated more than 2000 KVA shall be shipped without oil but with the tank filled with nitrogen or equivalent inert gas. A gas cylinder with suitable reducer connection and pressure gauge shall be supplied. These accessories shall become the property of the EPCC. The required quantity of oil shall be supplied separately in non-returnable drums.

4.2 Switchgear cubicles shall be packed and shipped in separate and convenient sections. All withdrawable equipment like circuit breaker are-chutes shall be packed and shipped separately. All relays and instruments shall be packed and shipped separately with their operating mechanisms temporarily arrested from movement, for transport purposes.

4.3 Batteries shall be shipped to site in dry, uncharged condition. Appropriate quantity of aid of the correct specific gravity shall be shipped separately in non-returnable porcelain jars packed in steel wire baskets.

4.4 Cables shall be shipped in non-returnable drums, adequately braced, and with cable ends adequately sealed to prevent ingress of moisture.

1.0 GENERAL

1.1 All equipment and system covered under this Contract shall be designed so as to enable Plant maintenance to be carried out in the least time, at the least cost and with minimum expenditure on support resources without adversely affecting the System/Equipment performance or safety characteristics.

1.2 For all major equipment including pumps, fans, drives, heat exchanges, large valves, etc., the VENDOR/CONTRACTOR shall provide appropriate structural steel members for mounting various handling devices which are necessary for the dismantling and reassembly of the equipment components during maintenance.

1.3 All the spare parts and maintenance tools supplied shall be new and unused.

1.4 The VENDOR/CONTRACTOR shall guarantee the OWNER/EPCC that before going out of production of spare parts, for the equipment furnished, he shall give at least 12 months advance notice to the OWNER/EPCC, so that the latter may order his requirement of spares in one lot, if he so desires.

2.0 MAINTENANCE TOOLS AND TACKLES

2.1 The BIDDER shall include in his scope of supply all the necessary tools, tackle, appliances and lifting devices for the effective maintenance and servicing of the equipment and components. The OWNER/EPCC reserves the right to exclude any of the above items from the VENDOR/CONTRACTOR'S scope of supply and effect price adjustments on the basis of the unit rates quoted by the VENDOR/CONTRACTOR.

2.2 The VENDOR/CONTRACTOR shall supply at least the maintenance tools and tackle described in Section-C. Each tool or appliance shall be clearly marked with its size and/or purpose and shall not be used for erection purposes.

3.0 SPARE PARTS

3.1 The BIDDER shall indicate and include in his scope of supply all the necessary essential spares and recommended spares as described in the Schedule of Spare Parts. The OWNER/EPCC reserves the right to finalise the exact quantities of the spare parts and effect price adjustments on the basis of the unit rates quoted by the BIDDER. The spares ordered by the OWNER/EPCC shall be delivered at the site not later than the date of issue of the Taking-over Certificate for the respective item of Plant. The BIDDER shall indicate in the 'Schedule of Spare Parts' the delivery period, from the date of acceptance of the Bid, of the spares

.

3.2 Essential spares are those considered necessary by the EPCC or the CEPCCING COBNSULTANT for normal Plant operation. A list of essential spares indicating type and quantity is given in the system Data Sheet – A3 of Section-C.

3.3 In addition to the spare mentioned above, the BIDDER shall also indicate in the Schedule of Recommended Spare Parts, his recommended list of spares, with unit prices, for three (3) years of normal operation of the Plant. This list shall be independent of the list of essential spares and the EPCC shall reserve the right to buy any or all of the recommended spare parts.

3.4 The BIDDER shall also indicate the service expectancy period for the spare parts under normal operating conditioning before replacement will be necessary. All spare parts shall be despatched along with the main Equipment concerned.

3.5 The BIDDER shall indicate the prices for each and every item in the 'Schedule of Essential Spares' whether or not be considers it necessary for the EPCC to have such spares. If the BIDDER fails to comply with the above or fails to quote the price of any spare it in the " Schedule of Essential Spares", the cost of such spares shall be deemed to be included in the Contract Price.

3.6 All spares supplied under this Contract shall be strictly interchangeable with the parts for which they are intended to be replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the Site, e.g. small items shall be packed in sealed transparent plastic bags with dessicator packs as necessary.

3.7 Each spare shall be clearly marked or labelled on the outside of its packing with its description and purpose. When more than one spare part is packed in a single case, a general description of the contents shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.

3.8 All cases, containers or other packages are liable to be opened for such examination as the EPCC may reasonably require.

3.9 The BIDDER shall bear in mind the shipment of Plant having ball or roller type bearings for which the following special provisions shall apply:

a) If temporary transit bearings are fitted to such Plant, then , additionally, two complete sets of service bearings shall be included and shipped with such Plant.

b) If the item of plant is shipped with service bearings in position, then, additionally, one complete set of service bearings shall be shipped with such plant.

c) If replacement of any bearing is required, due to indentation during shipment or other causes, the spare bearings shall be used to replace the faulty bearings.

TRAINING OF PURCHASER'S PERSONNEL

1.0 The VENDOR / CONTRACTOR shall train the OWNER / EPCC's engineering personnel in the shops, where the Equipment will be manufactured and / or in their collaborator's works and where possible, in any other plant/site where Equipment manufactured by the VENDOR / CONTRACTOR or his collaborator is under installation or test to enable those personnel to become familiar with the Equipment being furnished by the VENDOR / CONTRACTOR.

2.0 The period of training shall be adequate and mutually agreed upon by the OWNER / EPCC and the VENDOR / CONTRACTOR.

3.0 The training shall be so oriented as to make the OWNER'S / EPCC'S personnel proficient in operating the Equipment.

4.0 The OWNER'S / EPCC'S personnel shall also be trained for routine maintenance work and lubrication, overhauling, adjustments, testing and replacement procedures to be adopted for the Equipment offered.

5.0 The VENDOR / CONTRACTOR shall train the OWNER'S / EPCC'S personnel in carrying out minor repairs, during the operation of the Equipment.

6.0 The charges for training the OWNER'S / EPCC'S personnel, if any, shall be included in the price for supply, erection, testing and commissioning.

1.0 SCOPE

The specification covers general requirements of planning/scheduling work and progress reporting by the CONTRACTOR.

2.0 PROGRAMME OF WORK

2.1 The CONTRACTOR, within a period of two weeks from the date of notification of award of contract / letter of intent (LOI), shall furnish the EPCC with a schedule as detailed in clause 2.2 below of the sequence of work of manufacture and / or construction/erection to meet the agreed commissioning date of the system and shall ensure that all work / manufacture, shop testing and shipment of the equipment are in accordance with the required construction/erection sequence. The CONTRACTOR shall furnish the dates of manufacture, testing, despatch, completion of erection and commissioning or stages of work as called for in the schedules. Such work shall be divided into parts and items showing the order to be adopted for the execution thereof, ensuring that period of such programme does not exceed the period mutually agreed to.

2.2 Network Schedule / Linked Bar Chart

2.2.1 CONTRACTOR shall submit the 'NETWORK SCHEDULE' / 'LINKED BAR CHART' for his contract to the ENGINEER showing the logic and period of execution of the following minimum number of activities for review and approval.

(a) In case of equipment supply contract :

i. Commencement and completion of submission of final design data, specifications, calculations.

ii. Design and drawing submission / approval of different categories of drawings - Commencement and Completion.

iii. Procurement of raw materials and bought out items.

iv. Manufacturing process (indicating all major stages).

v. Shop inspection / testing (indicating all inspection and tests).

vi. Shipment (indicating each planned shipment).

vii. Other major key activities considered to be critical to the progress of the contract.

(b) In case of equipment supply and erection contract:

i. Items 2.2.1 (a) i to vii

ii. Preliminary works.

iii. Detail stages of construction and erection for each Equipment / Structure / System.

iv. Resources such as labour equipment etc. planned to be mobilised.

v. Commissioning indicating all major systems.

(c) In case of works contract:

i. Items 2.2.1 b (i) to (iv)

ii. Phased bulk requirements, if supplied, by EPCC.

iii. Cash flow if required, by the ENGINEER.

Appropriate time shall be allocated for the approval of the documents by ENGINEER and inspection of equipment (Factory Inspection Tests), and the same shall be indicated in the NETWORK SCHEDULE.

Work shall be carried out only in line with the NETWORK SCHEDULE / LINKED BAR CHART approved in writing by the ENGINEER.

2.2.2 The approved SCHEDULE shall not be amended unless the written consent of the ENGINEER has been obtained.

2.3 The type of outputs and number of copies of schedule to be supplied by the CONTRACTOR shall be mutually agreed upon.

2.4 The SCHEDULE shall be updated every month or at a frequency mutually agreed upon. Further, progress meetings shall be held at regular intervals. The meeting shall be attended by the ENGINEER and responsible representatives of any of the CONTRACTOR'S departments that the ENGINEER considers necessary to the meeting. The minutes of the meeting shall be issued on the day of the meeting duly signed by the participants.

3.0 PROGRESS REPORTS

3.1 During execution of the Contract/Manufacture, the CONTRACTOR shall furnish monthly progress reports to the EPCC or the ENGINEER in a format as specified by the EPCC or the ENGINEER, indicating the progress achieved during the month and total progress up to the month as against scheduled and anticipated completion dates in respect of key phases of work such as release of drawings for fabrication, procurement of raw material, fabrication, inspection, testing and shipment. The `CONTRACTOR shall also furnish any other information, in order to ascertain progress, if called for by the ENGINEER.

3.2 Corrective action for the slippage in the schedule also shall be highlighted in the progress report.

3.3 After Site work / erection has commenced, the CONTRACTOR shall provide the ENGINEER, at regular intervals, the detailed reports on the progress of all works under the contract. In case of erection, of critical items, CONTRACTOR shall submit a document indicating the proposed erection scheme with complete details of erection planning and resources proposed to be used for review / approval by ENGINEER. The CONTRACTOR shall submit photographs showing the progress of work at the time and in the manner specified by the ENGINEER. The CONTRACTOR shall provide the ENGINEER, with daily reports giving the number of labourers, skilled workers, supervisory staff and major construction equipment - his own as well as the sub-contractors employed by him, in addition to their locations at the work site.