	BHARAT HEAVY ELECTRICAL LIMITED		**Enquiry No. :**		
	HEAVY ELECTRICAL EQUIPMENT PLANT RANIPUR, HARDWAR - 249403, UTTRANCHAL, INDIA		**Due Date :**		
	CONTACT PERSON'S NAME/DESIGN./PHONE NO./E-MAIL (FROM PURCHASE DEPTT.)		**Supplier's Qtn. No.:**		
	SHRI Kaushik Roy, Mgr. (PPX-CAP.)		**Date :**		
	PHONE NO.:				
	E-MAIL ID.				
SPECIFICATION CUM COMPLIANCE CERTIFICATE OF CNC BORING AND FACING HEAD.					
	NOTE:-				
	1. Vendor must submit complete information against clause no. 13 (Qualifying condition). The offer meeting this clause would only be processed .				
	2. The vendor "Offered" Column and where applicable, the "Deviations" & "Remarks" Column of this format shall be filled in by the Vendor and submitted along with the offer. Inadequate / incomplete, ambiguous, or unsustainable information against any of the clauses of the specifications/requirements shall be treated as non-compliance.				
	3. The offer and all documents enclosed with offer should be in English language only.				
NAME & ADDRESS OF THE SUPPLIER :		**NAME & ADDRESS OF THE INDIAN AGENT :**			
TELEPHONE NOS.:		**TELEPHONE NOS.:**			
FAX NOS.:		**FAX NOS.:**			
E-MAIL ADDRESS :		**E-MAIL ADDRESS :**			

SCOPE: SUPPLY, INSTALLATION & COMMISSIONING OF CNC BORING AND FACING HEAD.					
Sl. NO.	DESCRIPTION FOR BHEL REQUIREMENT		OFFERED	DEVIATIONS	REMARKS
1	**PURPOSE & WORKPIECE MATERIAL:**				
1.1	Purpose: The CNC Boring and Facing Head is required for primarily machining of Butterss thread upto 20mm pitch on outer diameter of inlet pipe of HP Outer casing of 500 MW of Steam Turbines of different ratings. The Head should be suitable for Boring, Facing, Radius contouring and all type of Threading in Cylindrical and taper bores , etc. on high alloy Steel Castings.	Vendor to confirm			
1.2	Work Piece Material: The Boring Head shall be suitable for machining of Castings of High Alloy Steel, like GS17CrMoV511. The components to be machined will be mainly high temperature & creep resistant alloy steel castings of Mat. grade 17CrMoV511, X22CrMoV121 having tensile strength 40-95 Kg/mm2, %Elongation 15-22% & Hardness up to 300BHN. Components of Ferrous and non-ferrous metals like Carbon Steel, low & High Alloy Steel, Cast Steel, Cast Iron and similar other materials shall also to be machined.	Vendor to confirm			
2	**CNC BORING AND FACING HEAD: Model no: D' Andrea UT8-1000S or Equivalent.**	Vendor to confirm			
2.1	HEAD CONFIGURATION: Boring & Facing head complete in all respect, in compliance to specified requirements, including following:: - Drive motor - Encoder - Required hardware & software for interfacing with machine as specified at clause no. 4.0 -Tools for operation & maintinance.	Vendor to confirm			
2.1.1	Model No:	Vendor to inform			
2.1.2	Head body diameter	Vendor to inform			
2.1.3	Speed of rotation.	1 - 150 rev per min or more			
2.1.4	Radial axis independent positioning	Vendor to inform			
2.1.5	Radial Traverse.(Stroke)	350 mm or more			
2.1.6	Feed rate.	1-500 mm/min or more			
2.1.7	Boring Dia.' L' max. for internal diameter ϕL X G2 (Ref. Annexure-2)	ϕ 1000mm upto 850 mm depth or more			
2.1.8	Boring Dia. 'M' max. for internal diameter ϕM X G1 (Ref. Annexure-2)	ϕ 1600mm upto 350 mm depth or more			
2.1.9	Facing Dia. 'I' max. for internal diameter ϕI X G (Ref. Annexure-2)	ϕ 2000mm upto 150 mm depth or more			

2.1.10	Diameter (max) for machining External/Outer diameter indicating max. depth	ϕ 1200 mm upto 500mm depth or more			
2.1.11	Accuracy of Bore Size (Bore Tolerance); Surface Finish of bores; Facial and Radial Run outs; Repeatability accuracy achievable through machining using offered Boring Head.	H7; 1.6 microns Ra; Run outs: 0.030mm (Facial) and 0.030mm (Radial); Repeatability 0.005mm or better.			
2.1.12	Torque	10000 Nm or more			
2.1.13	Radial Force	10000 N or more			
2.1.14	Maximum cutting force in boring	Vendor to inform			
2.1.15	Maximum cutting force in facing	Vendor to inform			
2.1.16	Slide Counter Balance mechanism	Vendor to inform			
2.1.17	Set of standard Tool Holders and Tools, available with the offered Head. Item wise detail of complete set of Tools/tool holders are to be submitted with the offer. Complete details of any special arrangement offered to meet the specified requirement of Boring range are also to be submitted. Set of standard tools mentioned are as below: The tool holders 1 nos. each of the following: (K03 Tool Holders Kit of D' Andrea or equivalent comprising of following) * B01 Tool Holder suitable for MR/TU or equivalent. * B02 Tool Holder suitable for MR/TU or equivalent. * B15 Tool Holder suitable for MR/TU or equivalent. * MR80/130.80 Reduction or equivalent. * TU80/95.25 Cartridge or equivalent. * B50 MAS BT50 or equivalent.	Vendor to confirm & offer .			
2.1.18	Tool Holder with BT 50 taper for presetting of the Tools for offered Boring and Facing Head is to be offered with complete details.	Vendor to offer and submit			
2.1.19	Catalogue of the offered Head is to be submitted with the offer.	Vendor to offer and submit			
2.1.20	Requisite programming, operation and maintenance manuals, including detailed drawings, shall be supplied by the vendor in 3 copies. Complete assembly drawings of the Head with identification no. of each item for future reference will have to be supplied by the vendor.	Vendor to offer and submit			
2.1.21	Coolant system: External coolant with requisite flexible pipes on its snout is to be provided. The arrangement for its supply may be made through the coolant supply system available on the Head Stock.	Vendor to offer and submit			

3.1	High torque AC Servo Motor of Siemens make with incremental encoder is to be provided in the head. The complete technical details of the motor to be furnished. Data pertaining to current drawn by the motor for slide feed rate of 500 mm/min may be indicated.	Vendor to offer and submit			
3.1.1	Siemens Simodrive 611U system comprising of following items for controlling AC Servomotor 1FT6084-8AF71-3AA1 of CNC BORING AND FACING HEAD suitable for Skoda Ram Borer, (Ref. clause no. 4.0)	Vendor to confirm			
3.1.2	Infeed Module 10kW, Type 6SN1145-1AA01-0AA1 - 1 no.	Vendor to confirm			
3.1.3	Power Module 18/36 Amp, Type 6SN1123-1AA00-0CA1 - 1 no.	Vendor to confirm			
3.1.4	Control Unit SimoDrive 611U HRS, Type 6SN1118-0NH01-0AA1 -1 no.	Vendor to confirm			
3.1.5	Line Filter for 10kW infeed module, Type 6SN1111-0AA01-1AA1 - 1 no.	Vendor to confirm			
3.1.6	Over Voltage Limiter Module, Type 6SN1111-0AB00-0AA0 - 1 no.	Vendor to confirm			
3.1.7	Suitable power cable comprising of two parts: one part (approx. length 3 m) originating from the Boring head and terminating at a suitable connector on the machine headstock and second part (approx. length 40 m) between machine headstock and electrical cabinet routed via the existing caterpillar type cable drag chain and terminating on Siemens Servodrive. All cable ends shall be assembled with appropriate connectors.	Vendor to confirm			
3.1.8	Suitable signal cable comprising of two parts: one part (approx. length 3 m) originating from the Boring head and terminating at a suitable connector on the machine headstock and second part (approx. length 40 m) between machine headstock and electrical cabinet routed via the existing caterpillar type cable drag chain and terminating on the Siemens Servodrive. All cable ends shall be assembled with appropriate connectors.	Vendor to confirm			
3.1.9	Suitable cable for boring head limit switches comprising of two parts: one part (approx. length 3 m) originating from the Boring head and terminating at a suitable connector on the machine headstock and second part (approx. length 40 m) between machine headstock and electrical cabinet routed via the existing caterpillar type cable drag chain and terminating on a terminal strip in the electrical cabinet for onward connections to the PLC. Cable ends shall be assembled with appropriate connectors.	Vendor to confirm			
3.1.10	Pre-assembled cable to connect the proposed Siemens Servodrive 611U Control module Port X461 to 15-pin D-type connector of the Measuring card of Sinumerik 850M CNC System for position feedback and control.	Vendor to confirm			
3.1.11	Pin details of the connectors including signal names of all the connectors on the head to be submitted along with the drawing for interfacing with the machine.	Vendor to offer and submit			
3.1.12	Set of Coupling flanges for mounting the head on the Ram face of CNC Hor. Boring Machine shall be offered by the vendor. This should be assembled with the Boring Head.	Vendor to offer and submit			
3.1.13	Set of tools, wrenched etc required for operation & maintenance of head, list to be submitted.	Vendor to offer and submit			

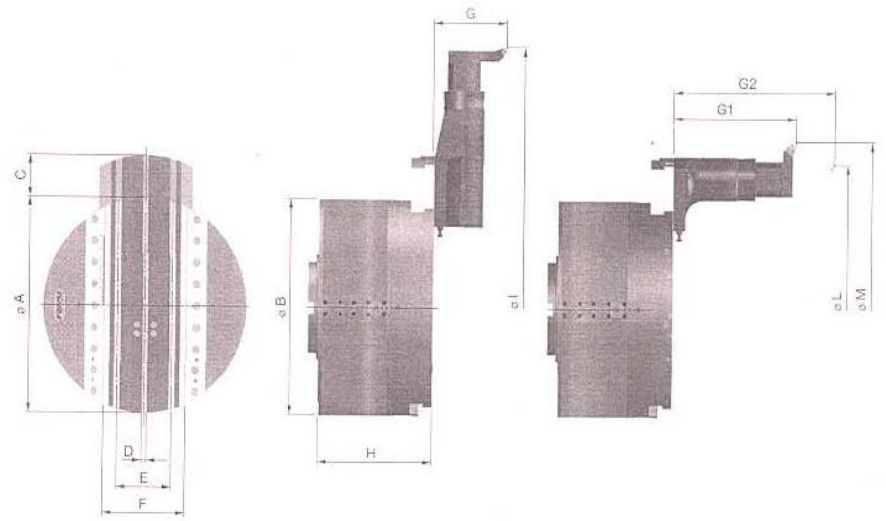
3.1.14	The design and construction of Boring Head should be such that splashed coolant should not seep into it.	Vendor to offer and submit			
3.1.15	The head is to be mounted on an existing CNC Horizontal Boring Machine , Skoda W200 HB-NC and its programmable axis is to be interfaced to CNC system of the machine. Details are given below at clause no. 4.0	Vendor to offer and submit			
3.1.16	Laying of servomotor power cable, incremental encoder signal and Limit Switches control cables from electrical control cabinet upto Boring and Facing Head through cable drag chain. These cables shall be terminated in-between at head stock with supplied connectors as described at Sl. no. 3.1.7, 3.1.8 & 3.1.9 of scope of supply above so that these cables could be disconnected by the operator at the time of dismounting of Boring Head.	Vendor to confirm			
3.1.17	Installation of supplied drive system inside the electrical control panel.	Vendor to confirm			
3.1.18	Connections of drive system and its interfacing with Sinumerik 850M CNC system of the machine.	Vendor to confirm			
3.1.19	Commissioning of supplied drive system.	Vendor to confirm			
4	**Specification of the CNC Horizontal Boring Machine , Skoda W200 HB-NC.**				
4.1	Boring Spindle dia.	200 mm			
4.2	Ram size	520 X 520 mm			
4.3	Ram travel	1600mm			
4.4	Spindle travel	2000mm			
4.5	Spindle taper (Pull stud/ draw bolt of the machine can be used, if needed)	ISO 60/ BT 50			
4.6	Spindle power	77 KW			
4.7	Spindle speed range	1-630 rpm			
4.8	CNC System	SINUMERIK 850M			
4.9	No. of axes active in the system	7			
4.10	Cables available with the machine for connection to U-tronic Head are having 19 pin sockets with Bundy connection (for motor, tachogenerator, and limit switch) and 12 pins sockets with Bundy connector (for encoder feed back) respectively. A protection cover must be provided on connectors of Head so that connectors are not damaged during handling of Head.	Vendor to Comment and offer accordingly.			
4.11	The head clamping on ram face is by a set of 4 bolts of M16 size on PCD 460mm. The coupling flange are to be made accordingly.	Vendor to confirm			
5	**TOOLINGS:**				

5.1	Tools for Proveout machining : All cutting tools, inserts, spares, tool holders, arbors etc., as recommended by vendor for complete prove out machining of inlet pipe as per clause no. 9.0 , to be offered by the vendor.	Vendor to confirm .			
5.1.1	In addition to clause no. 5.1 , additional Tools & consumables for offered tools, like square shank holder, inserts, screws, screw drivers, shims etc., should be offered for machining of similar casings, as below: 1. Square shank holders of each type: 3 nos. 2. Inserts of each type: 50 nos. 3. Screws, Screw drivers, Shims etc. of each type: 10 nos.	Vendor to confirm and offer.			
5.1.2	Additionally following tool holders / adoptors of D' Andrea or equivalent shall also be supplied. * MR80/130.80 Reduction or equivalent. (5 Nos.) * TU80/95.25 Cartridge or equivalent. (15 Nos.)	Vendor to confirm and offer.			
5.2	Preliminary Drawings/Sketches of the offered tools/ tool holders are to be submitted with the offer. Vendor to confirm that, in case of order, final Drawings/ Sketches for offered items shall be submitted to BHEL after PO.	Vendor to submit & confirm			
6	**SPARES:**				
6.1.0	Following mechanical, electrical and electronic spares are to be offered. (Unit Price of each item of spare shall be offered)	Vendor to confirm			
6.1.1	Hardened and ground lead screw / ball lead screw with backlash-free nut	1Set			
6.1.2	Worm and worm gear for the drive of lead screw/ ball lead screw	1Set			
6.1.3	Set comprising of all gears for the planetary chain (1 no. of each type)	1Set			
6.1.4	Set comprising of all bearings of the head (1 no. of each type)	1Set			
6.1.5	Limit Switches connectors, male and female (1 no. of each type)	1Set			
6.1.6	Motor power connector for cable	2Nos			
6.1.7	Motor incremental encoder connector for cable	2Nos			
6.1.8	Toothed belt	1No			
6.1.9	AC servomotor as supplied against clause no. 3.1	1No			
6.1.10	Limit switch block	1No			
7	**TRAINING:**				
	Training for BHEL Engineers in the fields of Programming, maintenance and Operations for a mutually agreed period shall be provided at BHEL's works.	Vendor to offer			
8	**INSTALIATION & COMMISSIONING:**				
8.1	The Head to be installed and interfaced on the machine along with other modification/ upgradation required on the machine by vendor.	Vendor to confirm			

8.2	Supplier to take full responsibility for carrying out the complete commissioning & testing of Head & all types of other supplied equipment/ accesories/tools. Service requirement like power, air & water shall be provided by BHEL. Other requirements like existing overhead crane and helping unskilled personnel shall also be provided by BHEL. Details of these requirements should be informed by vendor in advance.	Vendor to confirm			
8.3	Successful proving of BHEL component (Sl. No. 9.0) by the supplier & all tests, as mentioned at point no. 2.1.11 (accuracy of the head) shall form part of the commissioning.	Vendor to confirm			
8.4	Commissioning spares, required for commissioning of the Head within stipulated time, shall be brought by the supplier on returnable basis.	Vendor to confirm			
8.5	Commissioning charges if any, shall be quoted separately, for above activities.	Vendor to confirm			
8.6	Schedule of Commissioning to be submitted with the offer.	Vendor to offer			
9	**PROVEOUT OF BHEL COMPONENT :**				
9.1	Drawing nos. 0-10501-09500- 3 sheets and product Standard ST01030 for Buttress thread of 20 mm pitch of HP Outer Casing proveout components are enclosed. Job setting plan, Machining process plan & Requirement of Tools etc. for machining of proveout components shall be discussed and mutually agreed with vendor . Complete machining of ID, OD & face detail of inlet pipe, which include Turning of casting dia. of pipe including releaving groove width 57.5mm with radius R25 and face & R2.5 , R8, Facing & 2 nos. of face groove 50xR7.5 and face groove depth 42 mm showing D517 to D380, threading of 20mm pitch of Buttress Thread (Standard ST01030) on 2 pipes (Section P1 P1 of sheet 3) of HP Outer Casing, Drawing nos. 0-10501-09500 as per accuracies / finish using offered Head.	Vendor to offer.			
9.2	CNC programs, required for machining of Buttress of 20mm pitch on outer diameter of inlet Pipe of HP Outer Casing Drawing nos. 0-10501-09500, should be Generalized / parametric type, generated for single point boring tool. Vendor shall be fully responsible for machining of proveout components as per drawing and other requirements specified by BHEL to the full satisfaction of BHEL. Any additional item required for completion of prove out components shall be supplied by the vendor in the specified quantity without any financial implications to BHEL. Clarifications, if any required by vendor, regarding accuracy requirements of the proveout components, whether specified or not, should be discussed and cleared by vendor during initial technical discussions.	Vendor to confirm			
9.3	Vendor shall be responsible, financially or otherwise, for any deviation/ rejection in proveout component to the extent of cost of Casting/ Forging. In case of any deviation/ rejection of proveout component due to wrong machining or malfunctioning of the machine during proveout machining and also for the delay in machining due to improper recommended tooling etc. Vendor shall be responsible as per specified commercial condition in this regard.	Vendor to confirm			

10	Head acceptance : (Tests/Activities TO be Performed by Vendor)	Should be accepted & confirmed by Vendor			
10.1	Test to be carried out at BHEL works while commissioning the Head :	Vendor to inform			
10.2	Accuracy test as per point no 2.1.11	Vendor to confirm			
10.3	Prove out of BHEL component as per Sl. No. 9.0	Vendor to confirm			
10.4	1 week supervision of independent operation of Head by BHEL after job proveout.	Vendor to confirm			
11	**PACKING:**				
	Sea worthy & rigid packing for all items of complete Head.	Vendor to confirm			
12	**GUARANTEE :**				
	Supplier shall stand for full warranty, including Replacement of faulty parts, for complete Boring Head for a period of 2 year, after successful commissioning / acceptance of the Head.	Vendor to confirm			
13.0	**QUALIFYING CONDITIONS :**				
13.1	Only those vendors, who have supplied and commissioned at least one CNC Boring and Facing Head of offered type for CNC Horizontal Borer in the past ten years (on the date of opening of Tender) and referred Boring and Facing Head is presently working satisfactorily for more than one year (on the date of opening of Tender) after commissioning, should quote. The following information should be submitted by the vendor about the companies where referred Head (s) have been supplied. This is required from all the vendors for qualification of their offer.	Vendor to confirm			
13.2	Name of the customer / company where referred machine is installed.	Vendor to inform			
13.3	Complete postal address of the customer.	Vendor to inform			
13.4	Month & Year of commissioning.	Vendor to inform			
13.5	Model No./ Major Specs of CNC Boring and facing Head.	Vendor to inform			
13.6	Name and designation of the contact person of the customer.	Vendor to inform			
13.7	Phone, FAX no. and e-mail address of the contact person of the customer.	Vendor to inform			
13.8	The Boring and facing Head is presently working satisfactorily for more than 1 year (on the date of opening of Tender) after commissioning.	Vendor to certify			
13.9	BHEL reserves the right to verify information submitted by vendor. In case the information is found to be false/incorrect, the offer shall be rejected.	Vendor to accept & confirm			

Annexure - 2.



BUTTRESS SCREW THREADS

(With Perpendicular Flank)

1. SCOPE:

1.1 The buttress screw threads as per this standard is to be used where there is a high loading on the threads. In comparison to Buttress screw thread as per DIN 513, the threads as per this Standard have larger tooth thickness.

1.2 This Standard is based upon KUN 301.04-90

2. DESIGNATION:

2.1 BOLT THREAD (Outer thread).

2.1.1 Single start, right handed buttress thread (outer) of size d=580 & pitch P1 = 20 shall be designated on drawing or other documents as BUTT (O) 580x20 – ST 01030.

2.1.2 Double start , left handed buttress threads (outer) of size d=580 and pitch P2 = 40 shall be designated on drawing or other documents as BUTT (O) LH 580x40 –2 – ST 01030

2.2 NUT THREAD (Inner Thread):

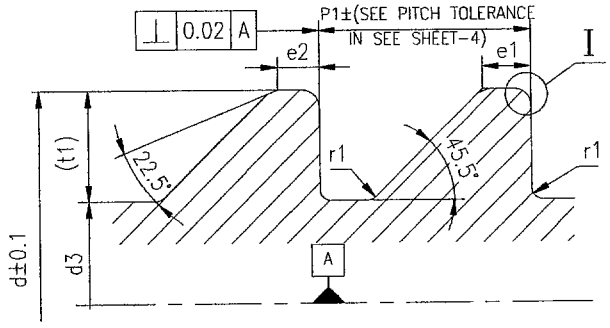
2.2.1 Single start, right handed buttress threads (Inner) of size d= 580 and Pitch P1=20 shall be designated on the drawing or other documents as BUTT (I) 580x20 – ST 01030.

2.2.2 Double start, left handed buttress threads (inner) of size d = 580 and pitch P2 =40 shall be designated on drawing or other documents as BUTT (I) LH 580x40–2–ST 01030

				नाम NAME	दिनाक एव हस्ताक्षर SIGNATURE & DATE
			अनुवादक TRANSLATED BY		
MEMBER PSC	N.R.DE	9/9/03	निर्माणकर्ता WORKED BY	R.K.NIGAM	07.09.03
TSX	D.L.OBEROI	12.9.2003	जांचकर्ता CHECKED BY	A.JAIN	09.09.03
सहमत विभाग AGREED DEPTT	नाम NAME	दिनाक एव हस्ताक्षर DATE & SIGNATURE	पर्यवेक्षणकर्ता SUPERVISED BY	A.K.JAIN	09.09.03
			स्वीकृति : APPROVED · P.C. BHAVNANI AGM(STE)		
REV.NO. 02			निर्माण PREPARED · STE	ज़ारी : ISSUED · STE(TE)	दिनाक : DATE · 22-4-03
Dt. 09/09/03					

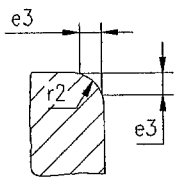
3. DIMENSIONS, TOLERANCES & SURFACE FINISH:

3.1 Dimensions of single start, right handed buttress thread (outer) shall be as per table-1 and Fig.1.



FIG–1

3.2 ALL OVER EXCEPT OTHERWISE STATED



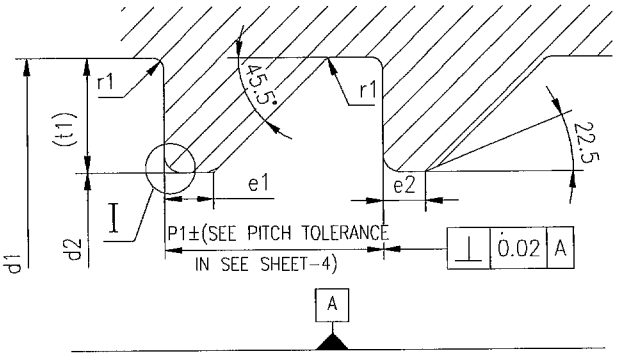
DETAIL I

Design of single start Buttress threads (outer) R.H.

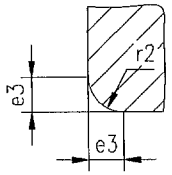
Table-1

P1	d3 ± 0.1	e1		e2		e3		r1		r2 ± 0.15	t1
5	d-2t1	0.8	+0.15	0.5	+0.15	0.4	-0.15	0.4	-0.15	0.8	3
9	d-2t1	1.8	+0.15	1.3	+0.15	0.8	-0.15	0.8	-0.15	1.6	5
20	d-2t1	4.5	±0.15	3.9	±0.15	1.15	±0.15	0.8	±0.15	1.6	10.5

3.2 Dimension of single start, right handed buttress thread (inner) shall be as per Table-2 & Fig.2



FIG–2



DETAIL I

Design of single start BUTTRESS thread (inner) R.H.

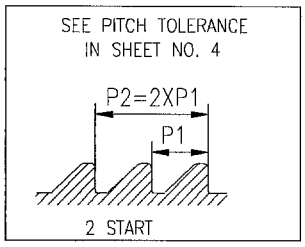
Table-2

P1	d1± 0.1	d2± 0.1	e1		e2		e3		r1		r2± 0.15	t1
5	d+1	d-2t1+1	0.8	+0.15	0.5	+0.15	0.4	-0.15	0.4	-0.15	0.8	3
9	d+1	d-2t1+1	1.8	+0.15	1.3	+0.15	0.8	-0.15	0.8	-0.15	1.6	5
20	d+3	d-2t1+3	4.5	±0.15	3.9	±0.15	1.15	±0.15	0.8	±0.15	1.6	10.5

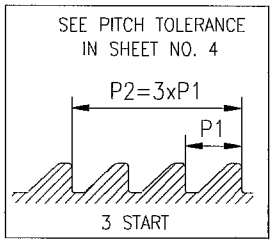
3.3 Multi start threads, left handed threads:

Multi start threads have same profile as that of single start threads. Therefore, the profile provided in profile gauge and profile tool for single start can also be used for multi start threads.
For left hand threads the abbreviation `LH' (Left hand) to be written before the thread size, as shown in clause 2.1.2 and 2.2.2.

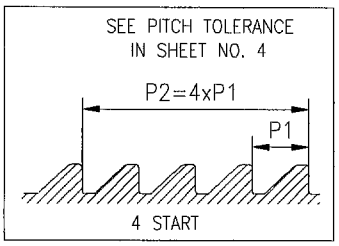
3.4 Dimensions of multi start buttress threads shall be as per fig.3, 4, & 5.



FIG–3



FIG–4



FIG–5

Pitch Tolerance

For 1X Pitch = ± 0.02
N x pitch = ± 0.01 X no. of pitches contained in a measured length.

3.5 Surface finish of thread is as per table shown in Table-3

Surfaces	Surface Roughness in µm
Contact Surfaces	1.6
Outer Thread- Outer Diameter	
Inner Thread- Core Diameter	
Other Surfaces	3.2

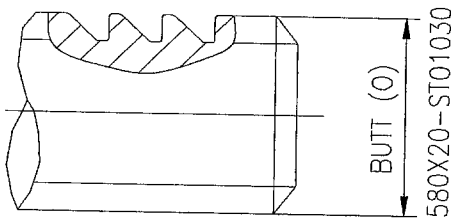
TABLE – 3

4. NOTES:

4.1 Indication of thread designation (as indicated above) on drawing is sufficient, but the profile of some threads should be shown in order to recognize the portion of the contact surface.

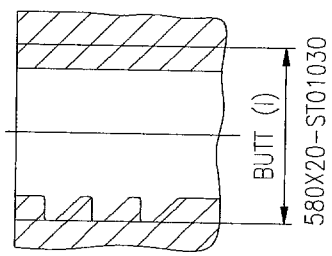
4.2 Depending on the load direction the position of the contact surface should be shown in the drawing as indicated below.

4.2.1



OUTER THREAD EXAMPLE

4.2.2



INNER THREAD EXAMPLE

5. **FINISH:** UNPLATED

6. **CROSS REFRRED STANDARDS:** NIL