

Bill of Quantity (BoQ)

SN	Description of items	Qty.	Rate (Nu./Rs.)
1	a. Hydraulic bolt tensioner M 72 X 4 with two Tommy bars as per drawing attached at Sketch- 1	2 Nos.	
	b. Hydraulic bolt tensioner M 64 X 4 with two Tommy bars per drawing attached at Sketch-2	4 Nos.	
	c. Hydraulic bolt tensioner M 80 X 4 with two Tommy bars per drawing attached at Sketch-3	2 Nos.	
	d. Hydraulic bolt tensioner M 90 X 4 with two Tommy bars per drawing attached at Sketch-4	2 Nos.	
2	Head Pump as per technical specification	1 No.	
3	Flexible Hose as per technical specification	8 Nos.	
4	a. Spare set of Seal [for item(a)]	2 Nos.	
	b. Spare set of Seal [for item(b)]	4 Nos.	
	c. Spare set of Seal [for item(c)]	2 Nos.	
	d. Spare set of Seal [for item(d)]	2 Nos.	
5	Spare set of Seal for Head Pump	2 Nos.	
6	Caps with seals as per technical specification	6 Nos.	

* One Set of seals = Set of seals required for one Bolt Tensioner assembly

** One Set of seals = Set of seals required for one Hand pump.

*** Distributor – If the Distributor is not needed separately, please mention it.

Note: -Each bolt tensioners should be supplied with two tommy bars i.e. for two bolt tensioners of M64; 4 tommy bars should be supplied. If tommy bars are common for all varieties then 20 tommy bars shall be supplied.

Technical Specification of Hydraulic Bolt Tensioners for Punatsangchhu-II HEP

A. SCOPE OF SUPPLY: One set of Hydraulic Bolt tightening Equipment (Hydraulically operated) and Sets of spares as per Annexure- 'A' to fulfill the following requirements.

1. **Bolt Tensioner with 2 Nos. Tommy Bars:** - The Bolt Tensioners shall be designed generally as per Sketch – A. The design of the equipment shall be suitable for the following applications and space constraints shown in respective sketches enclosed.

- (a) Coupling of Runner to Shaft as shown in Sketch-1
- (b) Joining of Halves of Top Cover and Pivot ring as shown in sketch – 2
- (c) Bolting of Pivot ring to Stay Ring as shown in sketch-3
- (d) Bolting of Top Cover to Stay Ring as shown in sketch -4

Description Size & Tonnage	Pressure (Nom.) (Kg/cm ²)		Stroke (mm)	Port Size	Tommy Bar Port Opening	Hole Dia.- Nut (d) in mm	Max. Outer Dia.- Top (A) in mm	Max. Outer Dia.- Bottom (B) in mm	Min. Inner Dia.- Bottom (C) in mm	Stud/Bolt Length above Nut (L) in mm	Application
	Working Pressure P1	Test Pressure P2									
M72X4 & 100T [Sketch-1]	To be specified by the supplier	1.5 times P1	10	1/4" BSP (M) with dowty seal for conn. To hose pipe at sr. no. - 4	70 mm (HT) x 90°x2 nos. at the base	12	280 See sketch -1	250 See sketch -1	195	92 mm	For coupling of Runner to shaft
M64X4 & 90T [Sketch-2]	do....	1.5 times P1	10-35	1/4" BSP (M) with dowty seal for conn. To hose pipe at sr. no. - 4	70 mm (HT) x 90°x2 nos. at the base	12	220 See sketch -2	190 See sketch -2	132	70 mm	For Joining of halves of Top cover and Pivot Ring
M80X4 & 145T [Sketch-3]	do....	1.5 times P1	10	1/4" BSP (M) with dowty seal for conn. To hose pipe at sr. no. - 4	70 mm (HT) x 90°x2 nos. at the base	12	230 See sketch -3	170 See sketch -3	142	90 mm	Bolting of Pivot ring to Stay Ring
M90X4 & 190T [Sketch-4]	do....	1.5 times P1	10	1/4" BSP (M) with dowty seal for conn. To hose pipe at sr. no. - 4	70 mm (HT) x 90°x2 nos. at the base	12	230 See sketch -4	190 See sketch -4	155	100 mm	Bolting of Top cover to Stay Ring

NOTE: - (a) Stroke for Bolt Tensioner M64-90T has been kept as 10-35 mm since this equipment shall be used for bringing closer the halves of Top cover or Pivot ring before joining the same with hardware called in assembly drawing of Guide Apparatus.

Technical Requirements:-

1 A. Hydraulic bolt tensioner M 72X4 With two Tommy bars. Qty.2 Nos

Technical Requirements:

- (i) Tensioner should generate at least 2261 KN load at 1500 bar pressure for M72 and should have stroke of min 10 mm. including Seal Kit.
- (ii) Tensioners should have Load cell and Bridge which can accommodate 3 to 4 different sizes of Puller sleeve and Nut rotating socket for future requirements .
- (iii) Max Dia of the tensioner should not exceed 210 mm for M72 Maximum height of the tensioner should be within 212 mm.
- (iv) Tensioner should have twin ports for quick connection of multiple tools and the ports should be on top of the tensioner.
- (v) Tensioner should contain Load cell and Bridge , Puller sleeve and Nut rotating socket .
- (vi) Total Weight of the tensioner should not exceed 35 kg (Load cell + Bridge)
- (vii) Maximum working pressure of tensioner should be 1500 Bar
- (viii) Bridge should have window for easy operation of Tommy bar.

1 B. Hydraulic bolt tensioner M 64X4 With two Tommy bars. Qty.4 Nos.

Technical Requirements:

- (i) Tensioner should generate at least 1466 KN load at 1500 bar pressure for M64 and should have stroke of min 10 mm. including Seal Kit.
- (ii) Tensioners should have Load cell and Bridge which can accommodate 3 to 4 different sizes of Puller sleeve and Nut rotating socket for future requirements .
- (iii) Max Dia of the tensioner should not exceed 174 mm for M64 Maximum height of the tensioner should be within 185 mm.
- (iv) Tensioner should have twin ports for quick connection of multiple tools and the ports should be on top of the tensioner.
- (v) Tensioner should contain Load cell and Bridge , Puller sleeve and Nut rotating socket .
- (vi) Total Weight of the tensioner should not exceed 30 kg (Load cell + Bridge)
- (vii) Maximum working pressure of tensioner should be 1500 Bar
- (viii) Bridge should have window for easy operation of Tommy bar.

1 C. Hydraulic bolt tensioner M 80X4 With two Tommy bars. Qty.2 Nos.

Technical Requirements:

- (i) Tensioner should generate at least 2261 KN load at 1500 bar pressure for M80 and should have stroke of min 10 mm. including Seal Kit.
- (ii) Tensioners should have Load cell and Bridge which can accommodate 3 to 4 different sizes of Puller sleeve and Nut rotating socket for future requirements .
- (iii) Max Dia of the tensioner should not exceed 210 mm for M80 Maximum height of the tensioner should be within 212 mm.
- (iv) Tensioner should have twin ports for quick connection of multiple tools and the ports should be on top of the tensioner.
- (v) Tensioner should contain Load cell and Bridge , Puller sleeve and Nut rotating socket .
- (vi) Total Weight of the tensioner should not exceed 34 kg (Load cell + Bridge)

- (vii) Maximum working pressure of tensioner should be 1500 Bar
- (viii) Bridge should have window for easy operation of Tommy bar.

1 D. Hydraulic bolt tensioner M 90X4 With two Tommy bars. Qty.2 Nos.

Technical Requirements:

- (i) Tensioner should generate at least 2845 KN load at 1500 bar pressure for M90 and should have stroke of min 10 mm. including Seal Kit.
- (ii) Tensioners should have Load cell and Bridge which can accommodate 3 to 4 different sizes of Puller sleeve and Nut rotating socket for future requirements .
- (iii) Max Dia of the tensioner should not exceed 240 mm for M90 Maximum height of the tensioner should be within 220 mm.
- (iv) Tensioner should have twin ports for quick connection of multiple tools and the ports should be on top of the tensioner.
- (v) Tensioner should contain Load cell and Bridge , Puller sleeve and Nut rotating socket .
- (vi) Total Weight of the tensioner should not exceed 50 kg (Load cell + Bridge)
- (vii) Maximum working pressure of tensioner should be 1500 Bar
- (viii) Bridge should have window for easy operation of Tommy bar.

Note:-

- a) All Bolt tensioners should have two ¼” BSP ports for hose connection. One port shall be in line with tommy bar port opening and the second one perpendicular to it. One port should be provided with a male adaptor suiting the hose pipe end fitting and the other port blanked with a plug.
- b) Piston and cylinder shall be applied with anti-Rust / hard chrome plating of 20 to 25 microns minimum.
- c) All Bolt Tensioners shall have safety against accidental ejaculation of the piston under any condition.
- d) All Bolt Tensioners should be of light weight construction suitable for overhead applications. The components of bolt Tensioners shall be of alloy steel construction for making them light weight. Preference will be given for light weight.

- 2. Hand pump: (1 no.)** Double speed, high pressure, and heavy duty pump suitable for working pressure of P1 kg/cm² (Highest amongst all bolt tensioners) with an oil tank of **5 litres**. Operating Pressure : 1500 Bar, Two Speed, Oil Displacement Per Stroke : 16.20 ml, Includes Pressure Gauge : 100 mm of 1500 Bar, Integrated Relief Valve, Includes Quick Disconnect Coupler of 1500 Bar. Discharge / stroke to be **10cc / 2mm** approximately. The pump shall be fitted with a pressure gauge of range 0 – P2 kg/cm² and having internal damping device which should be of reputed make like M/s Danfoss / M/s Switzer / Wika / Ashcraft / Budenberg / Kobolt. The delivery port shall be of ¼” BSP (Male) suitable for connections to hose pipes supplied along with equipment. **There should be a provision for changing the delivery pressure to adjust the capacity (Tonnage) of the Bolt Tensioner as per the requirement of application.** Maximum working pressure & test pressure are to be marked on each bolt tensioner.

3. **Distributor: (1 No.)**:- Distributor should have one inlet and four outlet ports (excluding pressure gauge port). All the ports shall be of ¼" BSP (Male) with dowty seal suitable for pressure of P2 kg/cm² (Highest test pressure amongst all bolt tensioners).

4. **Flexible Hose: (8 Nos.)**:- H.P reinforced flexible hoses, Hose of 10 Mtr length along with Male and female High Pressure Quick Disconnect Couper of 1500 Bar or highest amongst all bolt tensioners, whichever is higher, to fit the tensioners / pump – 2nos should be given along with supply which can withstand 1500 bar and its burst pressure should be 3000 bar. End connections should have elbows with ¼" BSP (Female) swivel nuts (at both ends). Hose pipes should be pressure tested at P2 kg/cm² (Highest test pressure amongst all bolt tensioners).

5. **Spare set of seals for Bolt Tensioners** : Sets of seals as per Annexure-A

6. **Spare Set of seals for Head Pump** : 2 sets

7. **Caps with seals** : ¼" BSP (female) with dowty seals to suit ¼" BSP (Male)

Connection in distributor suitable for testing pressure P2 Kg/cm² (Highest test pressure amongst all bolt tensioners).

B. GENERAL REQUIREMENTS.

1. Supplier to submit the reference list giving at least 5 references where similar equipment was supplied within past 3 years.
2. Drawing of Head Pump & Bolt Tensioner etc. with bill of material to be supplied along with the offer. All the items including spare rubber items are to be clearly marked in them.
3. Supplier to specify the materials of all the items of Bolt tensioner. Supplier to specify the mechanical properties (i.e. yield strength, tensile strength, elongation, etc.) also.
4. Test pressure should be as specified in the table and to be furnished by the supplier. Hydraulic pressure testing to be carried out for 30 minutes for all items except Bolt Tensioners. Duration for testing of Bolt Tensioners will be 2 hours.
5. All spare should have usability life even after 5 years of supply.
6. Other requirements for Bolt Tensioners are:
 - i. Supplier to take prior approval of QA plan & drawings by PHPA-2 before manufacturing. The outline dimensional drawing including weight, Bill of material etc. shall be supplied within 4 weeks from the date of ordering for approval.
 - ii. The thread are to be proven by 'GO'/'NO GO' gauges. Gauges are to be arranged by the supplier.
 - iii. The testing at test pressure and full stroke shall be done for 2 hours. No leakage is allowed.
 - iv. The testing at operating pressure and full stroke shall be done for 10 times. No abnormal operation (jerk etc.) is allowed

C. COMMISSIONING

Supplier have to depute their Service Engineer for commissioning of these equipments at the PHPA-2 premises. For which, 7 days prior intimation will be given to Supplier by PHPA-2 for availability of fronts/use of equipment's.

D. Documentation

Following documents shall be submitted to PHPA-2 in hard copies and in electronic form i.e. compact disc (CD) compatible with latest PCs.

- a) Test Certificate - 3 copies
- b) Guarantee Certificate - 3 copies
- c) Packing list - 3 copies
- d) O&M manuals - 3 copies
- e) Drawings - 3 copies (refer clause no-03 below)
- f) CD containing above - 2 nos.

In addition to above, one hard copy shall be supplied with each supply of the equipment.

'O&M' Manuals must contain OGA/ Drawings and Handling Instructions (as applicable).It should also contain Dos, Don'ts, Trouble shooting and component check points.

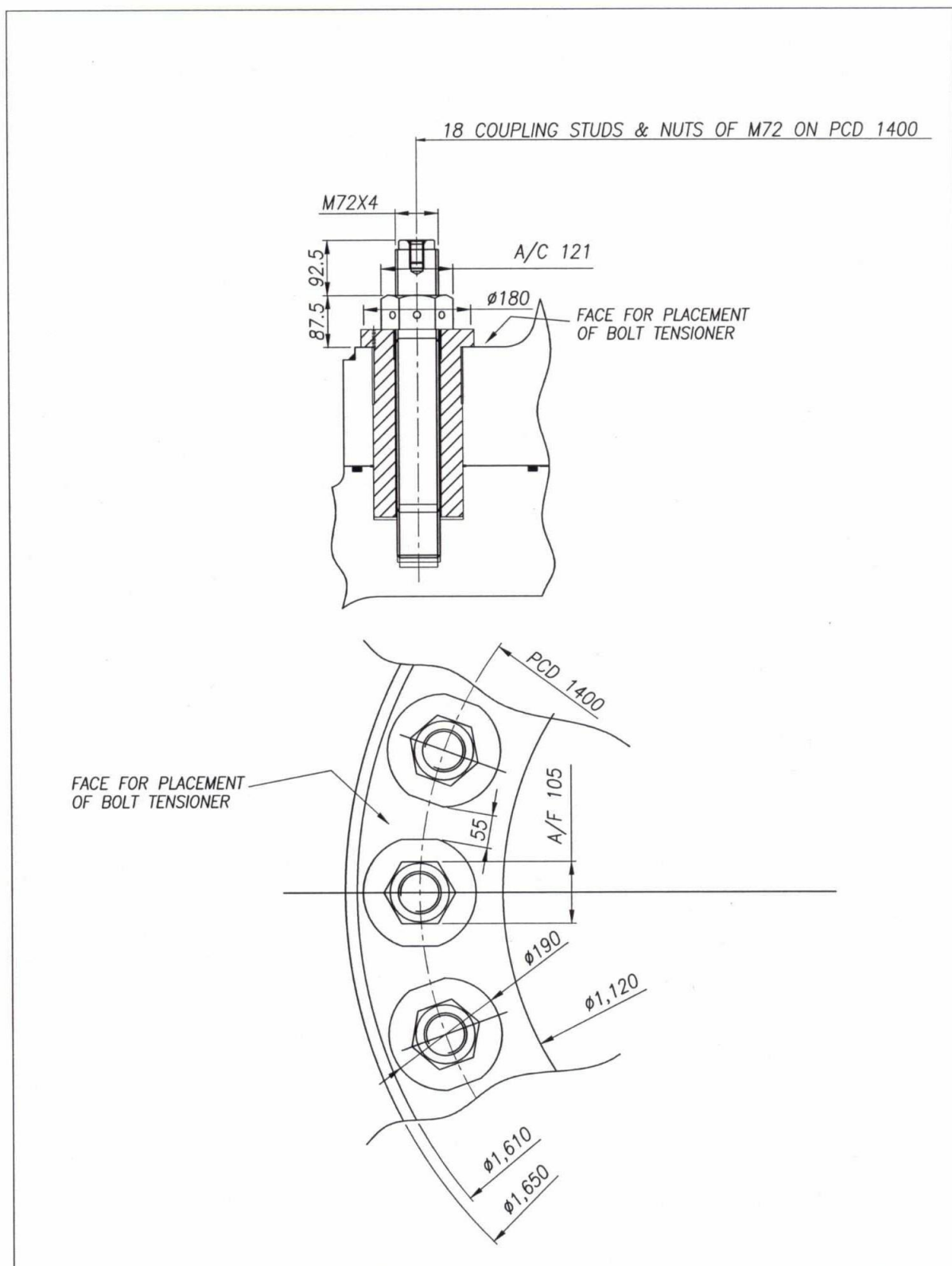
NOTE: *suppliers to offer their comments clause-wise to our purchase specification, without which offer will be treated incomplete & hence will not be considered for the technical evaluation.*

NOTE: CONNECTIONS PROTRUDING OUTSIDE BODY OF BOLT TENSIONER SHALL NOT BE IN LINE OF TOMMY BAR ACCESS OPENINGS AT BASE.

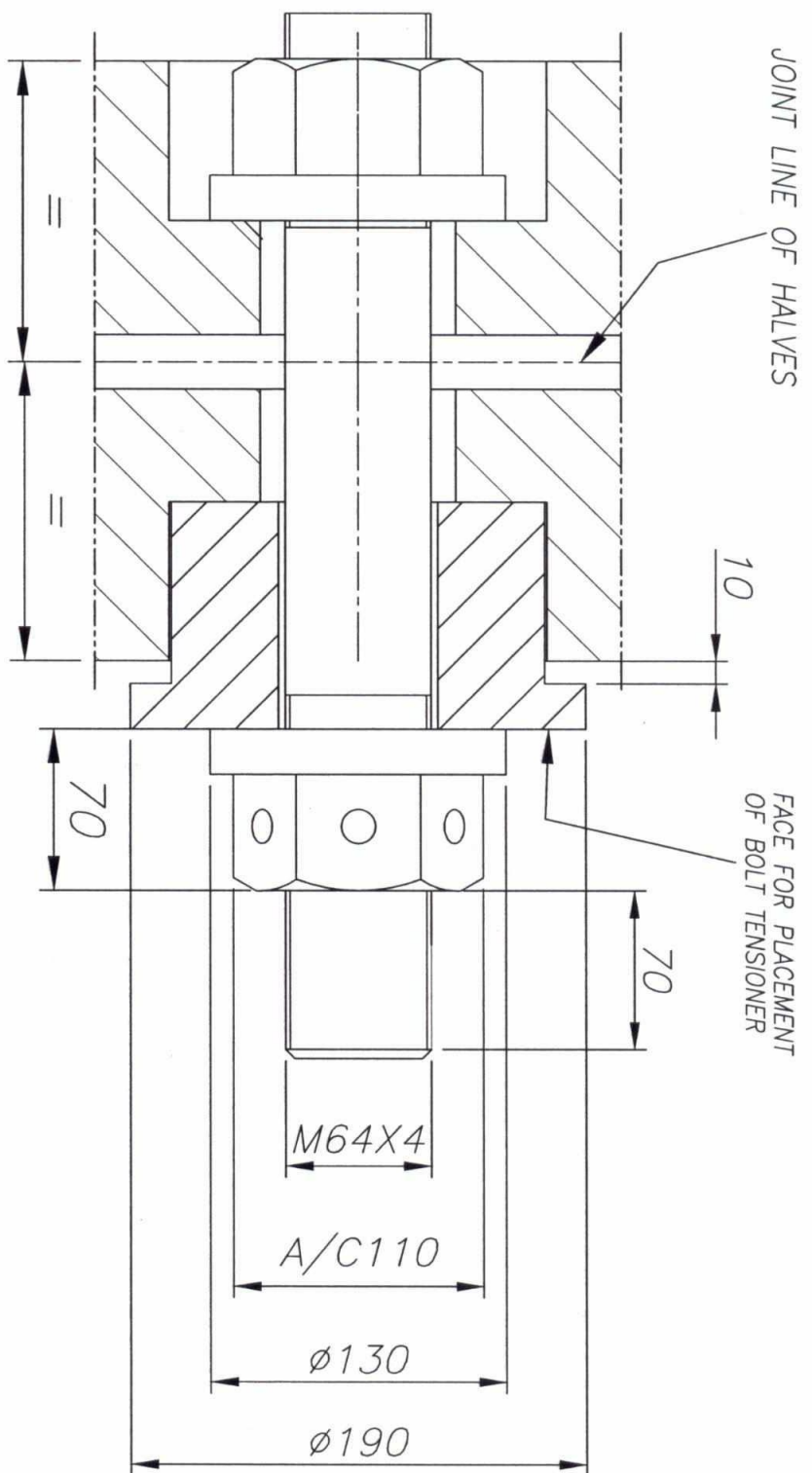
The diagram is a technical schematic of a Bolt Tensioner, labeled 'SKETCH-A'. It consists of a cross-sectional view at the top and a top view at the bottom. The cross-section shows a central vertical shaft (stud/bolt) passing through a series of components. Key dimensions and labels include: 'OUTER DIA-TOP (A)' for the top diameter, 'CLOSED HEIGHT' for the overall height, 'BOLT TENSIONER SIZE' for the central shaft diameter, 'STUD/BOLT LENGTH ABOVE NUT (L)' for the length of the shaft above the nut, '10 REF' for a reference dimension, 'HT 490°x2NDS' for the height of the tensioner body, '1/4" BSP PLUG WITH SEAL' for a plug on the side, '1/4" BSP ADAPTOR WITH SEAL' for an adaptor on the side, 'NUT HEIGHT' for the height of the nut, 'A/C OF NUT' for the arc of the nut, 'INNER DIA-BOTTOM (C)' for the inner diameter at the base, and 'OUTER DIA-BOTTOM (B)' for the outer diameter at the base. The top view shows three circular openings with crosshairs, indicating access points for the tensioner.

SKETCH-A

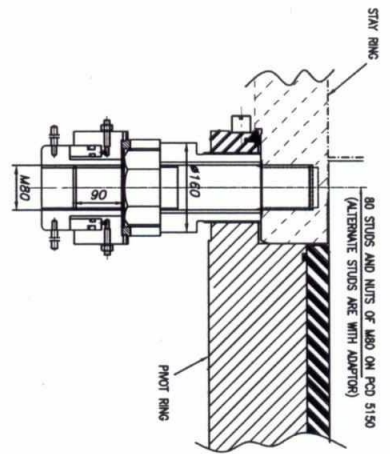
SCHEMATIC DRAWING OF BOLT TENSIONER



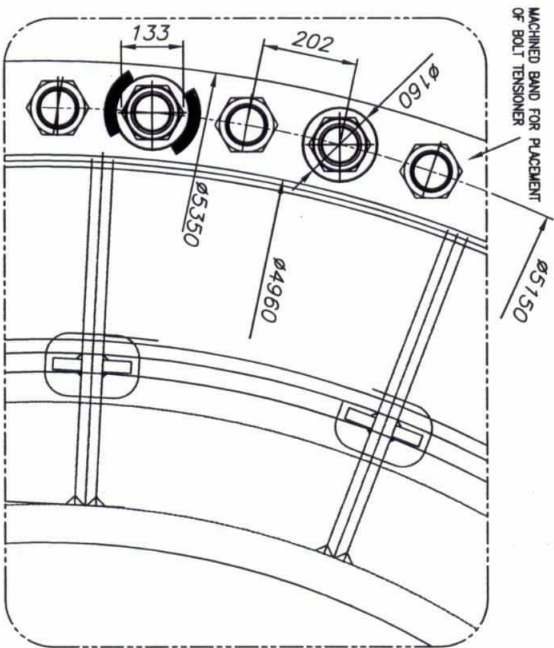
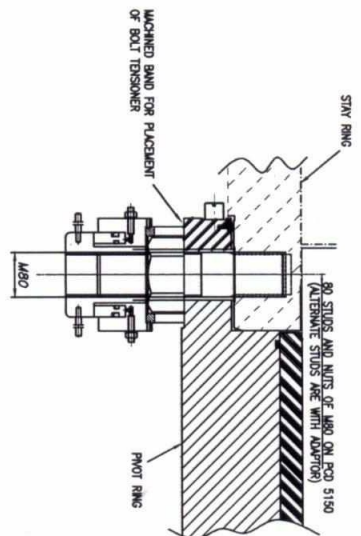
COUPLING OF RUNNER & SHAFT
FOR M72 – 100T BOLT TENSIONER
SKETCH-1



FOR JOINING OF HALVES OF TOP COVER & PIVOT RING
 FOR M64 - 90T BOLT TENSIONER
 SKETCH-2



BOLTING OF TOP COVER WITH STAY RING
SKETCH-4
FOR M80X4 - 145T BOLT TENSIONER



PLAN VIEW

BOLTING OF PIVOT RING WITH STAY RING
SKETCH-3
FOR M80X4 - 145T BOLT TENSIONER

PROFORMA FOR PERFORMANCE GUARANTEE

(To be executed on appropriate stamp paper of the value prescribed according to the laws of the state in which it is executed)

WHEREAS Punatsangchhu-II Hydroelectric Project Authority (hereinafter called the Authority which expression shall include, its successors, assigns, and nominees) and M/s..... (hereinafter called the Contractor have entered into Contract for supply order No..... dated.....)

AND WHEREAS one of the terms and conditions of the resultant contract (hereinafter called the Contract which expression shall include all amendments thereto or in) is that Contractor shall furnish a Performance Guarantee to the extent of(Five percent of the value of Contract as specified in the said Contract).

NOW THEREFORE, in consideration of premises aforesaid and at the request of the Contractor we.....Bank and having its registered office/head office at.....hereinafter called the bank so as to bind ourselves and our successors and assigns DO HEREBY irrevocably undertake and guarantee performance of the said Contract (which expression shall include all amendments thereto) by the Contractor and do hereby irrevocably undertake to pay upon your first written demand and without cavil or argument, any sum or sums within the limits of as aforesaid without your needing to prove or show grounds or reason for your demand for the sum specified.

We hereby waive the necessary of your demanding the said debt from the contractor before presenting us with the demand.

We further agree that the guarantee/undertaking herein contained shall remain in full force and effect up to.....

We further agree that the Authority shall have the fullest liberty without affecting in any manner our obligations hereunder without reference to us to vary any of their terms and conditions of the said contract and/or to extend time of performance by the Contractor from time to time or to postpone for any time on from time to time any of the obligations of the Contractor or powers exercisable by the Authority against the Contractor and/or forbear to force any of the terms and conditions relating to the said Contract, and that we shall not be released from our liability under this guarantee/undertaking by reasons of any such variations or extensions being granted to the said contractor for any forbearance and/or omission on the part of Authority of any indulgence by the Authority to the Contractor.

We further agree that as between us and the Authority for purpose of this guarantee/undertaking, any notice of breach of Contract/performance by the Contractor given to us by Authority and any amount claimed in such notice by the Authority on account thereof, shall be final and binding as to the factum of breach and the amount payable by us to the Authority hereunder relating thereto.

We further agree that this guarantee shall not be affected by any change in our constitution or that of the Authority.

Place:-

Date: -

Signed :
(Authorized Signatory)

Full Name :

Code No :

For Bank :

Stamp/Seal :