

	<u><b>BHARAT HEAVY ELECTRICAL LIMITED</b></u> <u>UNIT'S ADDRESS:</u>  <u>UNIT'S PHONE NOS.</u>  <u>CONTACT PERSON'S NAME/DESIGN./PHONE NO./E-MAIL (FROM PURCHASE DEPTT.)</u>		Enquiry No. :  Due Date :  Supplier Qtn. No.:  Date :	
<p align="center"> <u><b>SPECIFICATION CUM COMPLIANCE CERTIFICATE FOR CARBURISING AND HARDENING SYSTEM</b></u>  <u><b>COMPRISING OF CARBURISING, HARDENING AND TEMPERING FURNACES</b></u> </p>				
	1. Vendor(OEM) must submit complete information against clause no. 15.0 The offer meeting this clause would only be processed.			
	2. The "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.			
	2. The offer and all documents enclosed with offer should be in English language only.			
ADDRESS OF THE SUPPLIER : TELEPHONE NOS.: FAX NOS.: E-MAIL ADDRESS :	ADDRESS OF THE INDIAN AGENTS : TELEPHONE NOS.: FAX NOS.: E-MAIL ADDRESS :  SCOPE: SUPPLY, ERECTION & COMMISSIONING OF FURNACES COMPLYING WITH SPECIFICATION AS BELOW			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
<b>1.0 PURPOSE &amp; WORKPIECE MATERIAL</b>					
1.1	Purpose: Carburizing, hardening and tempering of Traction GEARS and PINIONS.	Vendor to confirm			
1.2	Work Piece Material: Alloy Steels, with requirement of case depths between 0.5 mm to 3.6 mm after heat treatment.	Vendor to confirm			
<b>2.0 SPECIFICATION:</b>					
<b>2.1</b>	The Pit type Furnaces System should comprise of :- <b>(A)</b> Electrically heated , carburizing Furnace with fixed seal retort, hydraulic cover lifting arrangements , air circulation fan . <b>(B)</b> Separate electrically heated, hardening furnace with fixed seal retort,hydraulic cover lifting arrangements, air circulation fan , <b>(C)</b> Separate electrically heated tempering furnace with hydraulic cover lifting ,air circulation fan., <b>(D)</b> Oil quenching tank with oil cooling systm and oil agitator. <b>(E)</b> Insulated cooling pit with water recirculation, <b>(F)</b> Post heat treatment spray washing System <b>(G)</b> PID controlled oxygen probe based feeding of methanol and acetone for control of carbon potential in carburising and hardening furnaces <b>(H)</b> PID type temperature controller with indication & chartless recording system , <b>(I)</b> Control panels for all the systems.	Vendor to confirm			
<b>2.2 CAPACITY &amp; SIZE</b>					
2.2.1	Accommodate maximum Gear Diameter - 1000mm	Vendor to confirm			
2.2.2	Maximum Single piece Gear Weight - 400 Kg	Vendor to confirm			
2.2.3	Minimum no. of Gears to be accommodated in a single charge-6 No. for Carburising ,4 Nos. for Hardening/ tempering.	Vendor to confirm			
2.2.4	Height of a single Gear Max - 200 mm	Vendor to confirm			

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2.2.5	Maximum temperature required for carburizing furnace- 1080 to 1100 degreeC	Vendor to confirm			
2.2.6	Maximum temperature required for hardening furnace- 980 to 1000 degreeC	Vendor to confirm			
2.2.7	Maximum temperature required for tempering furnace 480 to 500 degreeC	Vendor to confirm			
2.2.8	In Carburising furnace, retort should accommodate fixture of dia 1 meter and height 2 meters.	Vendor to confirm			
2.2.9	In Hardening furnace, retort should accommodate fixture of dia 1 meter and height 1.3 meters.	Vendor to confirm			
2.2.10	In tempering furnace, baffle should accommodate fixture of dia 1 meter and height 1.3 meters.	Vendor to confirm			
	<b>2.3 POWER PACK</b>				
2.3.1	Power for carburising furnace in KW to attain 1100 degree C in 4 HRS with full load.	Vendor to specify			
2.3.2	Power for hardening furnace in KW to attain 1000 degree C in 3 HRS with full load.	Vendor to specify			
2.3.3	Power for tempering furnace in KW to attain 500 degree C in 2 HRS with full load.	Vendor to specify			
	<b>2.4 RETORT</b>				
2.4.1	Thickness of retort for carburising min. -10 mm	Vendor to confirm			
2.4.2	Thickness of retort for hardening min. -8 mm	Vendor to confirm			
2.4.3	Material of retort - AISI 310	Vendor to confirm			

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2.4.4	Retort assembly should have adequate protection against heat loss and the sealing between retort and cover should be airtight for both the carburising and hardening furnaces.	Vendor to submit complete technical details including arrangement and material			
<b>2.5</b>	<b>TEMPERATURE CONTROL AND RECORDING SYSTEM</b>				
2.5.1	Temperature Control zone inside furnace (min 3 for carburising, 2 for hardening )	Vendor to confirm			
2.5.2	Digital temperature Controller, 1 per zone PID type	Vendor to confirm			
2.5.3	Make of controller (Eurotherm/Yokogawa/Chinolaxon/Honeywell/Endress hauser)	Vendor to confirm			
2.5.4	Chartless Temp. recorder(min 6 channels) with Ethernet connectivity for remote accessibility , (make- Yokogawa/ Eurotherm/ Chinolaxon/ Honey well / Endress hauser)	Vendor to confirm			
2.5.5	Audio visual alarm	Vendor to confirm			
2.5.6	Process Timer for each furnaces.	Vendor to confirm			
2.5.7	Safety/ Blind Temperature controller (make- Yokogawa/ Eurotherm/ Chinolaxon/ Honey well / Endress hauser)	Vendor to confirm			
<b>2.6.</b>	<b>FEEDING OF ACETONE AND METHANOL</b>				
2.6.1	Separate automatic feeding of Acetone and methanol	Vendor to confirm			
2.6.2	Oxygen probe based full cycle auto control system PID type and full cycle programmer	Vendor to confirm			
2.6.3	Single feed panel for supplying protective atmosphere to carburising and hardening furnaces with oxygen probe based single point control	Vendor to confirm			

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<b>2.7</b>	<b>ELECTRO HYDRAULIC COVER LIFTING ARRANGEMENT</b>				
2.7.1	Electro hydraulic lifting arrangement for lifting of furnace covers for - (a) carburising, (b) hardening, (c) tempering furnaces.	Vendor to confirm			
2.7.2	Arrangement for swinging of furnace covers	Vendor to specify			
2.7.3	Capacity of hydraulic power packs- for - (a) carburising, (b) hardening, (c) tempering furnaces.	Vendor to specify			
2.7.4	Capacity of recirculation fan- for - (a) carburising, (b) hardening, (c) tempering furnaces.	Vendor to specify			
<b>2.8</b>	<b>HEATING ELEMENTS</b>				
2.8.1	Heating element material - Kanthal make	Vendor to confirm			
2.8.2	Thyristorised control for each zone of Eurotherm/ Allenbradely make with harmonic supressor.	Vendor to confirm			
<b>2.9</b>	<b>OIL QUENCHING TANK</b>				
2.9.1	Size and capacity , min. 25000 litres	Vendor to confirm			
2.9.2	Material of the tank	Vendor to specify			
2.9.3	a. Cooling system for quenching oil of the tank -radiator type (Air to oil type).	Vendor to confirm			
	b. Capacity of oil cooling system to maintain temp of quenching oil- max. 80 degree C.	Vendor to specify			
2.9.4	Agitator for quenching oil tank - type & capacity	Vendor to specify			
<b>2.10</b>	<b>INSULATED COOLING PIT</b>				
2.10.1	Size	Vendor to specify			
2.10.2	Capacity -to hold the full carburising charge	Vendor to confirm			
2.10.3	Insulation	Vendor to specify			

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<b>2.11</b>	<b>SPRAY WASHING SYSTEM</b>				
<b>2.11.1</b>	Spray washing with suitable electrical and mechanical fittings	Vendor to specify			
<b>2.11.2</b>	Skimmer and sump to be provided for separation and collection of oil. Pump to be provided for removal of oil from sump for disposal	Vendor to confirm			
<b>2.12</b>	<b>INSULATION SYSTEM</b>				
<b>2.12.1</b>	Insulation system should consists of high thermal resistant bricks for base .	Vendor to specify			
<b>2.12.1.A</b>	Element holder should consist of bricks backed by Ceramic wool /ceramic tiles to minimise heat losses.For back insulation- Ceramic fibre blanket of density 128kg/m <sup>3</sup> . For hot face insulation- vacuum formed board , density 200kg/m <sup>3</sup> suitable for 1200 degreC.	Vendor to confirm			
<b>2.12.2</b>	Skin temp of the furnace on different positions should not be more than 40°C above the ambient temp.	Vendor to confirm			
<b>2.13</b>	<b>OPERATING CUM CONTROL &amp; INSTRUMENT PANEL</b>				
	A common panel having complete furnace control system ,operator controls, temperature controller and recorder, and emergency switchoff facilities shall be provided . All displays/ indications should also be conveniently placed accordingly. Layout showing complete details should be submitted. Complete control of furnace with required switches / keys should be provided in the panel for selection of required temperature, carbon potential and time etc.	Vendor to confirm			

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<b>2.14</b>	<b>CONSTRUCTION:</b>				
2.14.1	Vendor to furnish details of material, hardness & constructional details, including explanatory drawings, of various components/assemblies like hydraulic and Lubrication system etc.	Vendor to confirm			
2.15	<b>First filling of all required Oils &amp; Grease etc.</b> to be supplied by vendor. Indigenous source or Indian equivalent and specifications of oils/ greases are also to be provided by the vendor(except quenching oil).	Vendor to confirm			
	A. Grade of quenching oil	vendor to specify			
	B. Grade & quantity of Hydraulic , grease etc. to be	vendor to specify			
<b>3.0</b>	<b>ELECTRICAL :</b>				
3.1.1	415V AC $\pm$ 10%, 50HZ $\pm$ 3 HZ%, (3 Phase AC, <b>3 wire system without neutral</b> ) Power Supply will be provided by BHEL at a single point near the plant, as per layout recommended by Vendor. Power distribution required for connecting BHEL's power supply point to different panels and from panels to the furnaces, shall be the responsibility of vendor. Earthing along with required material is to be arranged by the vendor . All power and control cables from panel to the furnace ,should be fireproof.	vendor to confirm			
3.1.2	<b>Tropicalisation:</b> All electrical / electronic equipment shall be tropicalized	vendor to confirm			
3.1.3	All electrical & electronic control cabinets & panels should be dust and vermin proof - Class IP 54.	vendor to confirm			
3.1.4	All electrical components in the cabinets should be mounted on DIN Rail	vendor to confirm			

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3.1.5	All electrical and electronic panels including operator's panel should be provided with fluorescent lamps for sufficient illumination and power receptacles (for maintenance purpose) of 220Volts, 5/15 Amp AC. All adapters/receptacles should have compatibility with Indian equivalents.	vendor to confirm			
3.1.6	Motors shall conform to IEC Standards	vendor to confirm			
3.1.7	Vendor should ensure the proper earthing for the machine and its peripherals.	vendor to confirm			
3.1.8	In-cycle hour counter with reset facility.	vendor to confirm			
3.2	<b>SAFETY ARRANGEMENTS:</b>	vendor to confirm			
	Following safety features in addition to other standard safety features should be provided on the machine:				
	1. Furnace should have adequate and reliable safety interlocks / devices to avoid damage to the furnace, workpiece and the operator due to the malfunctioning . Furnace functions should be continuously monitored and alarm / warning indications should be provided				
	2. A detailed list of all alarms / indications provided on system should be submitted by the supplier.				
	3. All the pipes, cables etc. on the furnace should be well supported and protected. These should not create any hinderance to operator's movement for effective use of furnace.				
	4. All the rotating parts used on furnaces should be dynamically balanced to avoid undue vibrations.				
	5. Emergency Switches at suitable locations as per International Norms should be provided.				
	6. Oil & water pipe lines should not run with electrical cable in the same tray / trench.				



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3.3	<b>ENVIRONMENTAL PERFORMANCE OF THE FURNACE :</b> The furnace shall conform to following factors related to environment : (a) Maximum noise level shall be less than 85 dB(A) at normal load condition 1 M away from the furnaces with correction factor for back ground noise, if necessary. (b) Vendor may quote for fume extractor over oil quenching tank for quick removal of fumes as an accessory.	vendor to confirm			
4.0	<b>ULTRA ISOLATION TRANSFORMER</b>				
4.1	Indian make Ultra Isolation Transformer suitable for controls shall be supplied.	vendor to confirm			
4.3	Rating	vendor to specify			
5.0	<b>LEVELING &amp; ANCHORING SYSTEM</b>				
5.1	Complete anchoring system including foundation bolts, anchoring materials, fixators, leveling shoes etc should be supplied	vendor to confirm			
6.0	<b>TOOLS FOR ERECTION, OPERATION &amp; MAINTENANCE :</b>				
6.1	Special tools and equipment required for erection of the furnace shall be brought by the vendor. Necessary tools like Torque Wrench, Spanners, Keys, grease guns etc.for operation and maintenance of the furnaces should be supplied. List of such tools should be submitted with offer	vendor to confirm			
6.2	Fixtures one set each for carburising, hardening & tempering for the jobs specified in clause no.13.0..	vendor to confirm			

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<b>7.0 SPARES:</b>					
7.1	Itemised breakup of mechanical, hydraulic, electrical and electronic spares in sufficient quantity of the furnace for 2 years of trouble free operation on three shifts continuous running basis should be offered by vendor. The list to include following, in addition to other recommended spares: <b>(Unit Price of each item of spare should be offered). the spares, make, address of Supplier to be furnished.</b>	vendor to confirm			
	<b>a) Mechanical &amp; Hydraulic Spares:</b> All types of Pumps, Valves, Pressure Switches, Transducers, Flow Switches, Filters, Seals, O-rings, Hydraulic Hoses etc.	vendor to confirm			
	<b>b) Electrical /Electronic :</b> All types of Relays, Contactors, Proximity Switches, limit switches, timers, Push Buttons, Indicating Lamps, Semiconductor Fuses, Special Fuses, Circuit Breakers, Main Power Switch, etc.	vendor to confirm			
7.2	All types of spares for total furnace and accessories should be available for atleast ten years after supply of the furnace. If furnace control is likely to become obsolete in this period, the vendor should inform BHEL sufficiently in advance and provide drawings of parts / details of spares & suppliers to enable BHEL to procure these in advance, if required	vendor to confirm			
7.3	Recommended set of spares for all attachments are to be offered with details.	vendor to confirm			
7.4	Vendor to confirm that complete list of spares for machine and accessories, along with specification / type / model, and name & address of the spare supplier shall be furnished along with documentation to be supplied with the machine	vendor to confirm			
<b>8.0 DOCUMENTATION :</b>					
	Five sets of following documents (Hard copies) in English language should be supplied along with the machine	vendor to confirm			

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8.1	Operating manuals of furnace				
8.2	Detailed Maintenance manual of furnace with all drawings of assemblies/sub-assemblies/parts including Electrical /Electronic/ Pneumatic/ Coolant / Hydraulic circuit diagrams. All Assembly/ Sub Assembly Drawings shall be supplied with the part list also.				
8.3	Catalogues, O&M Manuals of all bought out items including drawings, wherever applicable.				
8.4	Detailed specification of all rubber items and hydraulic/lube fittings				
8.5	One additional set of all the above documentation on CD ROM, wherever possible.				
<b>9.0</b>	<b>TRAINING</b>				
9.1	BHEL Persons should be trained at BHEL for one week period in each area of (a) Electrical, Electronic maintenance for furnace & other supplied equipments (c) Mechanical & Hydraulic maintenance of the furnace & other supplied equipments (d) Operation of the furnace & other supplied equipments.	vendor to confirm			
9.2	Competent, English/Hindi speaking experts shall be arranged by the vendor during training for satisfactory & effective training of BHEL personnel.	vendor to confirm			

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<b>10.0</b>	<b>FOUNDATION :</b>				
10.1	Vendor shall submit the preliminary layout drawing for getting BHEL's approval within one month from the date of Letter of Intent (LOI) / P.O. Soil condition data will be furnished by BHEL along with the approval. Complete Foundation Design including details viz. static / dynamic load details etc. and Final Layout drawings shall be submitted by the supplier within three months after getting BHEL's approval. The layout should consist of all requirements pertaining to complete \furnace including space requirement for Isolation Transformer, & any other accessories. BHEL shall construct complete foundation for the furnace under supervision of supplier and at supplier's responsibility. Vendor should arrange equipments required for the testing of foundation, if required by the vendor. The vendor shall also indicate detailed specifications of grouting compound and Grouting procedure etc. for foundation bolts of the furnace.	vendor to confirm			
<b>11.0</b>	<b>ERECTION &amp; COMMISSIONING</b>				
11.1	Supplier to take full responsibility for carrying out the erection, start up, testing of furnace, it's control & all types of other supplied equipment , carburising/hardening of test pieces etc. Service requirement like power, air & water shall be provided by BHEL at only one point to be indicated by supplier in their foundation/layout drawings. Other requirements like crane and helping personnel shall also be provided by BHEL. Details of these requirements should be informed by vendor in advance.	vendor to confirm			
11.2	Successful proving of BHEL components by the supplier shall be considered as part of commissioning. All tests, as mentioned at <b>clause 14</b> (Furnace Acceptance) shall form part of the commissioning activity.	vendor to confirm			
11.3	All Cover Plates required for the furnace and its peripherals including pits shall be provided by the BHEL.				

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11.4	Schedule of Erection and Commissioning shall be submitted with the offer.	vendor to confirm			
11.5	Charges, duration, terms & conditions for E&C should be furnished in detail separately by vendor along with offer.	vendor to confirm			
<b>12.0</b>	<b>OPERATING CONDITIONS &amp; THERMAL STABILITY :</b>				
12.1	Total furnace and all supplied items should work trouble free and efficiently under following operating conditions and should give specified accuracies. Power Supply: Voltage: 415 V $\pm$ 10% , Frequency: 50 Hz $\pm$ 3%, No. of phases = 3 , 3 wire ,No Neutral Ambient Conditions: Temperature = 5 to 50 degree celsius Relative Humidity = 95% max. (Vendor to confirm that furnace is suitable for above and details of provisions on the furnace for the same are to be furnished by Vendor)	vendor to confirm			
12.2	Weather conditions are tropical, Atmosphere may be dust laden during some part of the year. Furnace shall be kept in the normal shop floor condition. Max. temperature variation is up to 25 deg Celsius in 24 hours.	vendor to confirm			
12.3	The furnace, including attachments and accessories, should be suitable for 24 hrs. continuous operation to its full capacity for 24 hour a day and 7 days a week throughout. Vendor to ensure and confirm the same.	vendor to confirm			

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13.0	<b>PROVEOUT OF BHEL COMPONENTS :</b>				
	Drawings of proveout components as listed below are enclosed. Vendor to submit preliminary process, time study and fixtures list recommended by them along with the offer for carburising , hardening & tempering . Change in process/tools may be mutually discussed and agreed. Complete cycle time of the heat treatment of the proveout components shall be done by Vendor at BHEL works to the specified required results . Fixtures one set each for carburising, hardening & tempering are to be provided by the vendor to prove the furnace after complete erection.Material for the proveout components shall be provided by BHEL. Vendor should submit the setting schemes, process sheets, fixture layouts, time studies etc. in advance for the proveout components . Vendor shall be fully responsible for achievement of heat treatment properties of proveout components as per drawing and other requirements specified by BHEL to the full satisfaction of BHEL . GW 14391613005, 14391660005, 14351616002, 14461699007 and Pinions 24391601008, 14391660004, 24301623007, 14461699006.	vendor to confirm			
14.0	<b>INSPECTION &amp; ACCEPTANCE: (Tests/Activities should be Performed by Vendor)</b>	Should be accepted & confirmed by Vendor			
14.1	<b>Inspection:-</b> Predispatch inspection for all the major items including control panel should be arranged at the Supplier's works to see the workmanship and adherence to BHEL's specification.				
14.2	<b>Tests/Activities should be carried out at BHEL works while commissioning the machine :</b>	vendor to confirm			

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14.2.1	Demonstration of all features of the furnace, control system & accessories to the satisfaction of BHEL for efficient and effective use of the furnace.	vendor to confirm			
14.2.2	Carburising,hardening and tempering of test gears/pinions to be carried out.	vendor to confirm			
14.2.3	Two weeks supervision by Vendor of independent operation of furnace by BHEL after job proveout	vendor to confirm			
14.2.4	Demonstration by actual use of all supplied controls and accessories to their full capacity.	vendor to confirm			
<b>15.0</b>	<b>QUALIFYING CONDITIONS :</b>				
15.1	Only those vendors, who have supplied and commissioned at least one Furnace of capacity specified in Clause 1 ,2.1 & 2.2. or higher and the supplied Furnaces are presently working satisfactorily for more than 5 years (more than 1 year if supplied to BHEL) after commissioning , should only quote. The following information is to be submitted by the vendor about the companies where similar Furnaces have been supplied. This is required from all the vendors for qualification of their offer.	Vendor to Specify			
15.2	Name of the customer / company where similar Furnaces or higher capacity Furnace(s) are installed. (Copy of Purchase Order should be furnished)	Vendor to specify			
15.3	Complete postal address of the customer.	Vendor to specify			
15.4	Year of commissioning. (Copy of Commissioning Report should be furnished)	Vendor to specify			
15.5	Application for which the Furnace is supplied with details of results achieved on the job.	Vendor to specify			
15.6	Name and designation of the contact person of the customer.	Vendor to specify			

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15.7	Phone, FAX no. and email address of the contact person of the customer.	Vendor to specify			
15.8	Performance certificate from the customers, on their letter head, regarding satisfactory performance of Furnaces supplied to them.	Vendor to Confirm			
15.9	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 Confirm			
<b>16.0</b>	<b>GUARANTEE :</b>				
16.1	12 months from the date of acceptance of the furnace except for items like fan, shaft, retort seals etc.	vendor to confirm			
<b>17.0</b>	<b>GENERAL :</b> The vendor should submit the details specification of all equipments along with all technical data indicating weight and area with the help of the OGA drawing with sectional views.	vendor to confirm			
17.1	Furnace Model	vendor to specify			
17.2	Total connected load (KVA):	vendor to specify			
17.3	Floor area required (Length, Width, Depth) for complete machine & accessories	vendor to specify			
17.4	Total weight/ Area of the furnace	vendor to specify			
17.5	Dimensions of largest part/ sub-assembly/ assembly of the machine	vendor to specify			
17.6	Vendor to submit, along with offer, reference list of customers where similar furnace have been supplied mentioning broad specifications of the supplied furnace i.e. Model, size, Load Capacity, control Systems etc	vendor to specify			
17.7	Detailed catalogues , sketch/ photographs of the furnace and accessories/ attachments should be submitted with the offer.	vendor to confirm			



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17.8	Hydraulic, Pneumatic & oil pipings should be preferably metallic except places where flexible pipings are essential.All the pipes required for the same shall be included in the standard scope of the machine.	vendor to confirm			