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SPECIFICATION FOR CNC DRILLING & OXY FUEL PROFILE CUTTING MACHINE

2 DESCRIPTION:

CNC Drilling & Oxy Fuel Profile Cutting Machine as per specification no. **COFMOW/IR/ CNC DRILLING & OFPCM/2018** is required for profile cutting of components along with the provision of drilling also.

2.1 The machine shall have following configuration:

2.1.1 The machine shall consist of longitudinal carriage, coordinate drive, torch, drilling and cutting heads, gas supply and distribution system including header, gas pipeline regulator, shed for gas cylinders etc along with other design features as specified in the specification.

2.1.2 Machines should have provision of drilling alongwith gas profile cutting station. and shall not include plasma power source, plasma torch, air compressor and consumables for plasma cutting. Consignee shall be able to add - on these items in future on the machine. **Bidder shall submit the complete design detail in GAD (General Arrangement drawing) in their offer.**

2.2 LEADING PARAMETERS

2.2.1 Major Parameters

| | | |
|-------------|---|--|
| 2.2.1.1 (i) | No. of gas cutting torches mounted on machine with height and auto ignition | 03 Nos |
| (ii) | No. of drilling head mounted on machine | 01No. |
| 2.2.1.2 | | |
| (i) | Cutting thickness range | Mild steel to IS-2062 & IRSM-41 thickness up to 63 mm |
| (ii) | Drill capacity and range | 12 to 50 mm diameter. Through hole on plate thickness up to 125 mm. |
| 2.2.1.3 | | |
| (i) | Cutting width capacity (with one torch) | 2500 mm |
| (ii) | Drilling width capacity | 2500 mm |
| 2.2.1.4 | Cutting length capacity | 600-13500mm |
| 2.2.1.5 | Circle cut | 1250 mm (maximum) |
| 2.2.1.6 | Piercing capacity with one torch | 63 mm (maximum) |
| 2.2.1.7 | Cutting speed range (Flame): | 100 mm/minutes to 600mm/minutes at varying thickness |
| 2.2.1.8 | Cut face quality and dimensional Tolerances | As per ISO-9013 |
| 2.2.1.9 | Cutting accuracy | +/- 0.5mm/meter and Max +/- 1.5mm in 12.5 meter length |
| 2.2.1.10 | Repeatability | +/- 0.3mm |
| 2.2.1.11 | Shape accuracy | +/- 0.6mm |
| 2.2.1.12 | Kerf compensation | +/- 15 mm in 0.1mm increment |
| 2.2.1.13 | Tool holder | BT40 or Higher |
| 2.2.1.14 | Bed size | Suitable for Drilling/Cutting on MS plate size 2500x13500 mm (minimum) |

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2.2.2 Other Parameters:

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| 2.2.2.1 | Positioning speed | 6000 mm/minute |
| 2.2.2.2 | Type of cutting torches | Nozzle Mixing type with automatic ignition |
| 2.2.2.3 | Type of torch adjustment | Motorized (and also with manual vertical adjustment) |
| 2.2.2.4 | Automatic tool changer | 8 stations with different drill bits |
| 2.2.2.5 | Plate clamping system | Pneumatic at point of drilling |
| 2.2.2.6 | Spindle power | Minimum 5 HP |
| 2.2.2.7 | Spindle speed | 100-3000 rpm or higher |
| 2.2.2.8 | Max. clamping Force | 600-900 Kgf |
| 2.2.2.9 | Testing of running track, testing of manufacturing accuracy of the oxygen-acetylene cutting machines and testing of working accuracy of automatically controlled oxygen acetylene cutting machines should be as per DIN- EN-28206 and operational characteristics as per [ISO 8206:1991] | |

Note: Deviation(s) shall not be accepted against abovementioned Major Parameters.

2.3 Performance Standards:

- 2.3.1 The machine shall be capable of carrying out all types of profile cuts, straight line cuts, circular cuts, bevel cuts of 0 to 45° in mild steel and alloy steel plates and slabs as per clause 2.2 of section-I using oxy acetylene fuel gas or LPG as the thermal cutting medium and combinations of drilling working either independently or simultaneously with profile cutting. The drilling capabilities shall be as per required diameters.
- 2.3.2 The machine shall be of heavy duty to withstand intensive use of three shifts-each of 8- hours duration per day and 25 days per month under arduous workshop conditions of maximum temperature of 50° C, relative humidity 95% and dusty atmosphere. It should be particularly suitable for mass production of a variety of intricately shaped components with dimensional accuracy and cut face quality as per ISO-9013 (for Oxy-Acetylene Gas Cutting) using any one torch.
- 2.3.3 The machine shall have the facility to easily switch between drilling and cutting modes/cycles. The drilling may be independently or simultaneously with profile cutting by the machine offered.
- 2.3.4 The machine shall be capable of working in a non-air-conditioned arduous workshop conditions and dusty atmosphere with an ambient temperature up to 50° C and relative humidity up to 95%.

2.4 Productivity:

- 2.4.1 The tenderer should also furnish cutting and consumption tables showing cutting speed, pressure and gas consumption for full range of thickness 5 mm to 63 mm. However, the cutting speeds for following thickness of MS plates (as per IS: 2062) should be specifically given for demonstration of cutting quality cuts along with the provision of drilling to maximum diameter and plate thickness (through hole).

- (i) 10.00mm thick MS plate
- (ii) 20.00mm thick MS plate
- (iii) 30.00mm thick MS plate
- (iv) 50.00mm thick MS plate
- (v) 63.00mm thick MS plate

- (b) The tenderer should also furnish drilling tables showing drilling speed, feed and consumption of consumables for full range of thickness 5 mm to 125 mm. However, the drilling speeds for following thickness of MS plates (as per IS: 2062) should be

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specifically given for demonstration of drilling quality with the provision of drilling to maximum diameter and plate thickness (through hole) as follows-

- (i) 10.00mm thick MS plate
- (ii) 20.00mm thick MS plate
- (iii) 30.00mm thick MS plate
- (iv) 50.00mm thick MS plate
- (v) 75.00mm thick MS plate
- (vi) 100.00mm thick MS plate
- (vii) 125.00mm thick MS plate

2.4.2 The basis of the timing should be clearly given with break up of all the parameters.

2.4.3 The timing should be maintainable for regular 8-hours shift for triple shift working, 6 days a week, with machine availability of 85%.

2.5 Prove out at firm's premises:

2.5.1 The machine required to be supplied tooled up for gas cutting shall be proved out to establish the claimed capability as given in above clause 2.3 & 2.4. The proving out shall be done at the inspection stage itself at the manufacturer's premises for:

- Cutting 63 mm thick M.S. plate (IS 2062) with gas cutting with one torch.
- Piercing 63 mm thick M.S. plate (IS 2062) with one torch.
- Drilling - 50 mm diameter. Through hole on M. S. plate IS2062 thickness up to 125 mm.
- Testing of the nesting software.

2.5.2 The material is to be purchased by the tenderer at his own cost and transportation. If the material is purchased by the tenderer from elsewhere, suitable documents confirming that material as shown above, to be furnished by the firm before start of prove out at firm's premises.

2.6 Prove out at consignee's works:

2.6.1 The items proved out at manufacturer's works shall be proved out at consignee works. The supplier shall demonstrate machine performance and prove out the claimed capability for successful commissioning at the consignee's works as given in clause 2.3 & 2.4 for a period of six working days of 8-hours in day shift. After such successful demonstration as herein before, the consignee shall take over and watch the machine performance for a period of one month, before the final proving test certificate is issued.

2.6.2 Only after successful completion of capability trials and productivity trials as per clause 2.3 & 2.4 at consignee's works during commissioning, the machine will be deemed to be commissioned. The PTC will be considered for issue by consignee after successful proving out period of one month.

3.0 QUANTITY & CONSIGNEE:

| S.N. | CONSIGNEE | QUANTITY REQUIRED | Specification No. |
|------|--|-------------------|--------------------------------------|
| 1 | Sr. SE Yard / Engineering WorkShop/ Kaligam/Sabarmati/ Ahmedabad-382470 / Western Railway | 01 | COFMOW/IR/ CNC DRILLING & OFPCM/2018 |

4.0 SCOPE OF SUPPLY:

4.1 The scope of supply shall include design, manufacturing, supply and installation, testing, commissioning and proving of machine on turnkey basis. It includes all the

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concomitant accessories/ equipment as detailed in the specification and other concomitant accessories/ equipment, which the manufacturer considers essential to make the machine fully operational, when installed and commissioned. The requirement of utility etc. if any should be clearly indicated by the tenderers in their offers. It shall also include installation and commissioning of related equipment, like (a) I-Beam & Base plates for mounting of machine rails, (b) Installation I-Beam, Base plates for mounting, Anchor Bolts and chemicals etc of training of personnel in operation and maintenance of machine and supply of technical documentation.

The specification covers supply and commissioning of two axes CNC Gas Profile Cutting machine of bridge/gantry portal design suitable for profile cutting as well as drilling facilities using Auto CAD/ other international cad software drawings.

The scope of supply for machine shall consist of:

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| 4.1.1 | Basic machine of size to cover the leading parameter as per clause 2.2 | |
| 4.1.2 | (i) | Cutting torch (High speed torch) and 3 nos. (profile cut) including torch holder, motorized height adjustment) mounted on machine |
| | (ii) | Drilling head 1 no. (Drill Head) |
| 4.1.3 | | Cutting nozzles 4 sets (each set comprising of cutting nozzles minimum 4 nos. to cut material from 5 to 63 mm and heating nozzles 2 nos.) (Bidders shall indicate the total nos. of nozzles) Cutting nozzles of 4 sets required for LPG cutting also. |
| 4.1.4 | | CNC System As per clause 1.2.8 |
| 4.1.5 | | Longitudinal track with rails As per requirement of clauses 2.2.1.3 & 2.2.1.4 of section- I with space for loading and unloading |
| 4.1.6 | | Gas Manifold System 1 set (comprising of following equipment): |
| 4.1.6.1 | | Gas control valves for preheating and cutting on the control panel. |
| 4.1.6.2 | | Complete manifold for 4-cylinder DA, 6 cylinder of heating oxygen and 8 cylinders of cutting oxygen which shall include heavy duty gas regulators, pressure gauges and back flash arrestor fitted on the gas cylinders. This shall include the following. |
| 4.1.6.2.1 | | Heavy duty hose pipes Blue 10mm dia for heating oxygen 50 mtrs. |
| 4.1.6.2.2 | | Heavy duty hose pipes Black 10mm dia for cutting oxygen 50 mtrs. |
| 4.1.6.2.3 | | Heavy duty hose pipes Red 10mm dia for LPG/DA as per IS:447/1988. 50 mtrs. |
| Gas cylinders are excluded in each case. | | |
| Hose pipes makes: Standard/reputed make only | | |

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- 4.1.6.3 Heavy duty gas regulators, pressure gauges, gas piping / cables i.e. complete gas supply system mounted on machine. Reusable flash back arresters to be provided both at regulator end and also at torch end in all torches for both LPG/DA and oxygen. These items should be of reputed make as per ISO/DIN standard.
- 4.1.7 Hose and cable conveyor 15 m long 1 unit
- 4.1.8 Automatic piercing system Automatic piercing system up to 63 mm capacity (profile cut and drilling head) simultaneously

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4.3

OPTIONAL ACCESSORIES:

Following optional accessories will be quoted by the tenderer. Cost of optional accessories shall be quoted separately and shall not be included in the basic price of the machine. Cost of optional accessories will not be taken for commercial evaluation of the firms.

4.3.1

Bidders shall quote for a suitable integrated fume extraction & dust filtration system. Such system should ensure minimal maintenance and free from clogging. **Bidder shall indicate the complete detail of the system in the offer.**

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for evaluation of tenders. However, Purchaser / consignee reserve the right of ordering of AMC.

- 4.3.3 Bidder shall indicate the cost of extension of track length per meter in their offer.
- 3.3.4 Complete set of spares for CNC system of the machine
- 4.3.5 Electronic trouble shooting kit consisting of test equipments such as Multi-meter of Fluke/ HP make and tools such as Conventional Plier, Nose Plier, Screw Driver Sets, Tweezer, Allen Key sets etc. of Wiedmuller/ taparia make which are required for regular maintenance shall be provided.
- 4.3.6 Separate Stand alone air conditioners for Electrical panel, CNC System & Operator Console.
- 4.3.7 Automatically and manually swivel mounted quadruple torch assembly to perform bevel cutting.
- 4.3.8 Any other accessory which can improve the productivity, performance, reliability, efficiency, or enhance the capability of the machine as a whole or part thereof, should be quoted as optional accessory.

6.0 OTHER ITEMS TO BE QUOTED:

The following items will need to be quoted additionally though will not be part of commercial evaluation:

- 6.1 Optional Accessories with break up of individual items
- 6.2
- 6.3 Consumables with break up of individual items
- 6.4 Cost of Preventive Maintenance during 1st & 2nd year of Warranty Period.

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ABBREVIATIONS

| | |
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| A-1,A-2, A-3, A-4 | Standard paper sizes |
| AC | Alternating Current |
| AMC | Annual Maintenance Contract |
| ASA | American Standards Association |
| AT | Acceptance of Tender |
| BG | Bank Guarantee |
| BIS | Bureau of Indian Standard |
| CAD | Computer Aided Design |
| CAM | Computer Aided Manufacturing |
| CD | Compact Disc |
| CE | <i>Conformité Européenne</i> /European Conformity –Conformity to European Community Directives |
| CME | Chief Mechanical Engineer |
| CME/PCM | Chief Mechanical Engineer/Post Contract Management |
| CNC | Computer Numeric Control |
| CPU | Central Processing Unit |
| COFMOW | Central Organisation for Modernisation of Workshops |
| COS | Controller of Stores |
| DA | Dissolved Acetylene |
| Db | Decibel |
| DC | Direct Current |
| DFT | Dry Film Thickness |
| DIN | <i>Deutsches Institut für Normung</i> /German Institute for Standardization – German Standards |
| DNC | Direct Numerical Control |
| DOL | Direct On Line (Type of switches) |
| DVD | Digital Versatile Disc |
| DXF | Drawing Exchange Format |
| EIA | Electronic Industries Association |
| EPROM | Erasable Programmable Read Only Memory |
| ESSI | Enhanced Synchronous Serial Interface |
| FA&CAO | Financial Advisor & Chief Accounts Officer |
| FDD | Floppy Disc Drive |
| FPS | Foot Pound Second |
| GA (Drawing) | General Arrangement (Drawing) |
| HDD | Hard Disc Drive |
| HRC | Hardness Rockwell 'C' Scale (value) |
| Hz | Hertz |
| ICF | Integral Coach Factory |
| IEC-Pub | International Electro technical Commission - Publication |
| IGES | Initial Graphics Exchange Specification |
| IRSM | Indian Railway Standard-Mechanical |
| IS | Indian Standard |
| ISO | International organization for standardization |
| JCN | Joint Commissioning Note |
| JIS | Japanese Industrial Standards |
| JRI | Joint Receipt Inspection |
| KVA | Kilo Volt Ampere |
| kW | Kilo Watt |
| LAN | Local Area Network |
| LC | Letter of Credit |
| LCD | Liquid Crystal Display |
| LD | Liquidated Damages |
| LED | Light Emitting Diode |
| LOA | Letter of Acceptance |

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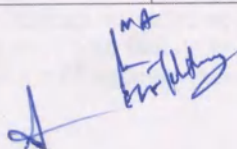
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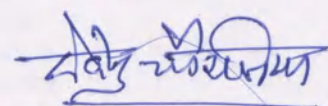
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| LPG | Liquefied Petroleum Gas |
| M&P | Machinery & Plant |
| MD | Machine Data |
| MKS | Meter Kilogram Second |
| MMC | Man Machine Communication |
| MPCB | Motor Protection Circuit Breaker |
| MS | Mild Steel |
| NC | Numeric Control |
| NCK | Numerical Control Kernel |
| NEMA | National Electrical Manufacturer's Association |
| NIT | Notice Inviting Tenders |
| OEM | Original Equipment Manufacturer |
| PBG | Performance Bank Guarantee |
| PC | Personal Computer |
| PCB | Printed Circuit Board |
| PDF | Portable Document Format |
| PLC | Programmable Logic Controller |
| PMC | Preventive Maintenance Cost |
| PTC | Proving Test Certificate |
| PU | Production Unit (Any of the six Railway Production Units e.g. RCF, ICF etc.) |
| PVC | Poly Vinyl Chloride |
| RAL | Reichs-Ausschuß für Lieferbedingungen und Gütesicherung / Imperial commission for Delivery Terms & Quality Assessment -German standard for Colour Tone & Hue |
| RAM | Random Access Memory |
| RDSO | Research Design & Standards Organisation |
| RS-232 | Recommended Standard-232 -- A type of serial port interface defined by EIA |
| SS | Stainless Steel |
| TFT | Thin Film Transistor |
| UPS | Uninterruptible Power Supply |
| USB | Universal Service Bus |
| VGA | Video Graphics Array |
| WBG | Warranty Bank Guarantee |
| WiFi | Wireless Fidelity |

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Technical SpecificationSpecification No. COFMOW/IR/CNC DRILLING & OFFPCM/2018

1. **BASIC DESIGN FEATURES**
 - 1.1 **General Characteristics**
 - 1.1.1 The general characteristics of the machine shall be as per clause 3.0 of Section I I.
 - 1.2 **Specific Characteristics**
 - 1.2.1 **Rigidity-Control-Safety**
 - 1.2.1.1 The machine offered shall be of gantry design, rigid, robust and of sturdy construction. It should be of welded and distortion free box construction to provide outstanding strength and rigidity and also freedom from undesirable vibrations during its operations and intensive use. The bridge has to be of sturdy design to withstand the drilling load during drilling operation. The top portion of the stand, which is likely to get damaged in due course of flame cutting operation, should be made as per replaceable convenient segments.
 - 1.2.1.2 All controls and operating elements should be ergonomically designed for ease of operation and for good man machine communication. Control panel incorporating necessary control should be easily accessible. All operating elements and indicators on the machine and CNC function keys should be systematically grouped to ensure easy operation of the machine and should be of air-tight membrane, designed to prevent ingress of dust, dirt and foreign particles from outside. In CNC system machines, an alfa-numeric display of various parameters shall be available.
 - 1.2.1.3 The machine shall incorporate adequate and ample safety devices to provide complete protection to the operator and the machine under normal working conditions. The machine shall move on longitudinal axis over heavy duty machined railway rails machined on 3 sides. Heavy duty machined Railway rails will be provided along with installation pads for ease of alignment and with suitable clamping arrangement. The safety feature shall include but not be limited to the following: -
 - 1.2.1.3.1 Flash-back proof torches, back-fire and flash back arrestor to conform as per safety standard and IS standard. Provision to stop the machine should also exist either within or at nearest point to each cutting torch station, to prevent damage to the hoses, solenoid valve, regulator etc.
 - 1.2.1.3.2 Automatic cut-off for any malfunction
 - 1.2.1.3.3 Fire fighting system consisting one no. fire extinguisher of 10kgs. (minimum) liquid type and 10 kgs. dry powder type may be integrated with the system.
 - 1.2.1.3.4 The machine shall meet the standards laid down by ISO 14001. The noise emanated from the machine shall be well below 75 ± 3 decibels during day time & 70 ± 3 during night time. This will be proved out by six joint readings taken at random within one meter from the machine, through three months of proving period.
 - 1.2.2 **Longitudinal Carriage**
 - 1.2.2.1 The longitudinal carriage should consist of a main beam located on two low design side carriages fitted with wheels of adequate strength and ample size. The arrangement should cover complete work area.
 - 1.2.2.2 The main beam shall have welded construction (box type) and suitably stress relieved after welding operation to provide high strength and rigidity and light weight to ensure high production rates.
 - 1.2.2.3 The machine travel in both longitudinal and crosswise direction should be guided by linear motion guides (bearing type) and should be suitably protected rail tracks through lateral

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guide roller bearings fitted on to the side carriages for longitudinal travel. The wheels shall be hardened and ground. Details shall be provided by the tenderer.

- 1.2.2.4 The guide track for longitudinal travel of the cantiportal (machine) should consist of heavy rail/box type beam sections of high strength and precisely machined at the top, bottom and sides for optimum alignment accuracy on the longitudinal axis. Box structure with welded/bolted guide ways has to be avoided.
- 1.2.2.5 The track rails to be mounted on to leveling blocks having suitable provision for altering the rail level and straightness with the help of adjusting bolts/eccentric bolts on the mounting etc. to ensure accurate alignment and level of track rails. The machine track with the leveling block should be fixed on
- (i) steel beam carried on steel pedestal/uprights located at suitable intervals.
- (ii) Steel beam on floor. Long travel guides are to be fixed on rigid structure with provision for possible alignment in line with floor undulations & locking arrangement.
- 1.2.2.6 The straightness of guide rail accuracy i.e the deviation from straightness after adjustment should be + 0.5mm or better measured over a length of 10 meters. as per DIN 8523.
- 1.2.2.7 The longitudinal track should have provision for longitudinal movement of carriage suitably strengthened for ample strength and rigidity & durability.
- 1.2.2.8 The longitudinal travel should be through dual synchronized AC digital Servomotors of Delta/ Panasonic of equivalent make coupled with backlash free planetary gear box of Nidec Shimpo or equivalent make. AC servo-drive motors, heavy duty gear box and back lash free precision racks & pinion. The machine shall be equipped with twin-sided drives in the longitudinal direction and one for cross axis with AC digital drives. The rack module shall be standard length of 1.0 meter and in multiple thereof. The racks shall be suitably protected from dust. The travel must be vibration free. The machine shall stop automatically, if the longitudinal drive fails to run synchronously. The cross axis shall be of precise linear guide ways and drive output through rack and pinion mechanism. The linear guide ways for the longitudinal drive system shall be of assembly on rigid frames resting on floor with a concrete structure. The system should display the cause of failure.
- 1.2.2.9 A traverse hose drag-chain system to take care of the cutting station hoses & cables shall be fitted on the main beam for hose and cable feeding/ conveyor shall be fitted on the main beam for hose and cable suspension. The hose trolleys shall be fitted with ball bearings to ensure easy movement.
- 1.2.2.10 Provision of manual shifting/positioning of machine through suitable clutching de-clutching system shall be available.
- 1.2.2.11 ✓ The gantry of the machine should move at least one meter away from the worktable to facilitate safe loading of plates/ unloading of cut components & skeleton.
- 1.2.2.12 ✓ The carriage should have a provision for free wheeling arrangement so that the carriage can be brought to required position manually.
- 1.2.3 Coordinate Drive**
- 1.2.3.1 The coordinate drive system comprising of electric/electronic and mechanical components should be inertia free and high dynamic drive type.
- 1.2.3.2 The machine having CNC shall have a reliable, proven and versatile CNC system with capabilities, functions and accurate control of various parameters. For particulars of CNC control system refer to clause 1.2.8 of Section-II. The tenderer should furnish the model, make and other performance/technical details of the CNC system along with technical pamphlets etc. with the offer.
- 1.2.3.3 The longitudinal travel should be through digital controlled AC servo-drive motors and positive drive precision rack & pinion and zero backlash gear box or suitable ball screw and rod arrangement. The machine shall be equipped with twin-sided synchronized drives in the longitudinal direction. The drive & guide elements should be suitably protected from dust. Bidders shall furnish details. In case other type of longitudinal travel

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drive is offered, it should be explained clearly in details with its features.

1.2.3.4 The mechanism of travel for both longitudinal movements and transverse movement of the machine offered should be LM guide along with rack & pinion arrangement or suitable ball screw and rod arrangement driven by AC servo motors, which shall be described giving details specifically highlighting technical features that ensure precise and error free movements in both directions of the machine. Both these drives have to be provided with manual override to take care of any unevenness of the plate.

✓ 1.2.3.5 **Cutting Table/Working Table:** Bidder shall submit the design detail with drawings / sketch of cutting table in their offer.

✓ 1.2.3.6 **Holding device for oxy & DA cylinder:** Bidder shall submit the design detail with drawing/sketch in their offer.

1.2.4 **Other Design Features:** The machine should have following features:

✓ 1.2.4.1 The torch cutter shall have anti back-fire feature and shall be provided with flash back arrestor. The anti back fire feature shall be clearly described. Make of the same shall be specified. Each gas line feeder should be provided with regulators.

✓ 1.2.4.2 Manual as well as motorized vertical torch slide with ball screws rod or rack & pinion arrangement for up and down movement of cutting torches. Non-contact type proximity switches have to be used to take care of end limits. Details shall be provided by tenderer. **Suitable arrangement (Conveyor type or better) shall be provided for easy removal of scrap from cutting table and filtration of coolant. (Conveyor type or better)**

✓ 1.2.4.3 The control console shall be mounted at the front of the main carriage at a convenient height for easy operation and suitable height for debris removal. The panel shall contain all the controls for gas circuit, CNC system, drive, torch lifting etc. The following operation should be covered in the panel:

✓ 1.2.4.3.1 Individual selector switches to lower or raise individual torches/ drilling head.

✓ 1.2.4.3.2 Master switch to raise torches simultaneously.

✓ 1.2.4.3.3 Individual switches for operation sequence with functions permanently written in English at each position of switch e.g. Ignite, Preheat, Cut in auto mode and manual mode.

✓ 1.2.4.3.4 Control and supply of all gases to the individual torches from the panel.

✓ 1.2.4.4 Automatic shut down of cutting action to minimize possible damage to work in case of accidental loss of contour during cutting operation.

✓ 1.2.4.5 The torch holder with ball screw arrangement or rack and pinion arrangement for two dimensional (up/down, back/front) torch adjustments. The torch holder should have the flexibility/provision to mount an extension arm, so that the position of the torch can be brought forward if required. All hoses at the torch station should be suitably protected by metal spiral hoses and enough loop for permitting easy up & down movement.

✓ 1.2.4.6 Arrangement for angular adjustment (tilting) of torches in either lateral or longitudinal direction to facilitate cleaning and changing of nozzles.

✓ 1.2.4.7 Effective locking arrangement for torch holders to maintain exact torch spacing and verticality/rigidity of torch during cutting action.

✓ 1.2.4.8 Hose and cable drag & chain on both traverse & longitudinal axes to eliminate strain and drag on cable supply and hoses.

1.2.4.9 Kerf control (compensation) provision.

1.2.4.10 The gears and spindle should be of alloy steel, hardened and ground. Material composition, process of heat treatment and hardness to be specified.

1.2.4.11 Standard right hand cutting motion i.e. while facing the machine from its front, extension of main bars (bridge/gantry) to be on the right side of the operator.

1.2.4.12 Wipers for cleaning of track/rail on both X and Y axes.

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- 1.2.4.13 Automatic height control to maintain the established torch height above the work piece during cutting operation regardless of undulation in the plate.
- 1.2.4.14 Extra space should be available to permit parking of unused torches out of way.
- 1.2.4.15 The graduation on the machine should be in metric system. Provision should also exist for conversion to either in inch or metric system as required.
- 1.2.4.16 Automatic ignition system with sparks plugs for four torches shall be available on the machine.
- 1.2.4.17 Automatic corner slow down system shall be available on the machine.
- 1.2.4.17.1 Feature of cutting of the manual drawing.
- 1.2.4.17.2 Feature of cutting operation as per Auto CAD drawings input through USB port.
- 1.2.4.18 The control system shall be such that the job can be processed from the middle of programme in case of any power failure or interruption, instead of resetting and starting from the zero point.
- 1.2.4.18 The layout of electrical & electronic components shall be such that they are easily accessible for maintenance purpose. They shall be fastened with adequate number of screws & bolt with flat and spring washer.
- 1.2.4.19 Torch up & down motion should be through ball screw rod or rack and pinion.
- 1.2.4.20 All movements have to be properly guided to arrest slackness.
- 1.2.4.21 LMG, Ball screw rod or rack and pinion, guides, tracks etc. have to be covered with effective guards, in addition to wipers, to protect from dust, dirt, slag, molten metal etc.
- 1.2.4.22 Complete drilling cycle to be controlled from control panel.
- 1.2.4.23 Drilling canned cycle to include tool section, clamping of plate, drilling start & drilling stop.

1.2.5 Gas Supply and Distribution

- 1.2.5.1 The machine should be equipped with independent 8 cylinders' bank each of cutting oxygen, 6 cylinder bank for heating oxygen and 4 cylinder bank for LPG/DA acetylene gas cylinders a gas manifold system with cut off valve as per cl. 4.1.6 of Section I to suit the cutting performance parameters given in Clause 2.2 of Leading Parameters of Section-I and for ensuring equal pressure (pressure balancing at each torch station). It should be possible to turn on or off the gas supply by means of central solenoid valve provided on operator's control panel. Three stage CNC auto piercing control system for higher thickness is preferred and the methodology has to be addressed in detail in the offer.
- 1.2.5.2 Tethered female threaded plugs on gas manifold outlets should be provided for blocking of the supply line to such torches as not in use or when torches are required to be removed from service.
- 1.2.5.3 A gas economiser (saver) to allow high flows for pre-heating and piercing and to automatically throttle the gas flow back to low setting during cutting operation to economise on the cost of cutting should be provided. Details to be furnished.
- 1.2.5.4 Gas flow control valves on each torch for 'acetylene' 'pre-heat oxygen' and 'cutting oxygen'. These will be in addition to the solenoid control valves in gas circuit to stop gas supply when a torch is not in use or when a solenoid valve is defective or such other purposes.
- 1.2.5.5 Gas manifold should have changeover system for all gases to avoid idle time for replacement of empty gas cylinders with filled cylinders.
(A foolproof suitable system consisting "Tees" & "Valves NRV type" OR better to be incorporated in Gas Manifold system" to enable switch over to Pipeline supply system.)

1.2.6 Off-Line Programming Station:

- 1.2.6.1 For offline programming, firm should supply one desktop computer of HP make model no pro 3300 or similar business series model of equivalent or higher configuration of DELL/IBM/LENOVO make.

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1.2.7 Off-Line Programming Software / Nesting software

- 1.2.7.1 Two user license copy of the software with life time validity to be provided
- 1.2.7.2 The software shall have the following capabilities:
- 1.2.7.2.1 Graphically supported creation of part programs suitable for use on this machine.
- 1.2.7.2.2 Should be able to generate all types or shapes of valid 2D part drawing files.
- 1.2.7.2.3 Manual editing of drawings should be possible
- 1.2.7.2.4 Should have facility to read IGES and DXF files (CAD files from Auto CAD/ Uni-graphics softwares) for preparing CNC programs and software shall have CAD facilities.
- 1.2.7.2.5 Should be able to generate standard shapes such as square, rectangle, ellipse, polygon, circle etc.
- 1.2.7.2.6 Automatic as well as manual tool path generation of nested layout of parts having free geometry.
- 1.2.7.2.7 Automatic & manual tool path generation and sequencing should have provision for part wise operations.
- 1.2.7.2.8 It should be possible to read the CNC program on the PC screen as well as print it.
- 1.2.7.2.9 Facilities for providing common cut and open cut in nesting.
- 1.2.7.2.10 Programming aides like mirroring, rotating, subroutine etc. should be available.
- i) Automatic and manual advanced true shape nesting.
 - ii) Automatic part pattern reorganization.
 - iii) Adaptive nesting for multi head machines.
 - iv) Accurate cost and time estimators.
 - v) Drag, drop and bump features.
 - vi) Pre-piercing and tip-up crash avoidance.
 - vii) Common line and bridge cut.
- 1.2.7.2.11 It should be possible to save the complete nesting diagram sheet in the form of DXF files for use on any other computer.
- 1.2.7.2.12 Read existing CNC codes file for this machine & convert them into shape file/ DXF file (for the complete nesting). It should be possible to store the files so generated for future use on any other nesting software.

1.2.8 CNC SYSTEM:

- 1.2.8.1 The machine shall be equipped with a microprocessor based computer numerical control system capable of providing programmed machine control functions like displacement of slides to desired positions at pre-selected speeds, gas flow controls etc. Provision for control features for gas cutting on the CNC control console shall be provided. The system shall be from a source having service facility in India.
- 1.2.8.2 The basic CNC system shall be two axes (X, Y) gas cutting machine control system. CNC shall have suitable features for gas cutting system. It shall essentially comprise of central processing unit, control panel and display unit. It shall be compatible to Windows NT/Windows XP or higher. It shall be possible to load the next programme even when the machine is cutting. The standard features of the system shall be fully described in the offer. The system shall include the following features :
- 1.2.8.2.1 Control over all shape cutting and marking and other machine functions.
- 1.2.8.2.2 Manual Data Input (MDI) up to 512K Byte part programming non-volatile memory equivalent to 80 meters of tape or more with edit functions for entering parts

programmers, data correction, scroll, cursor movement etc. Facility should exist for further part programming through USB port / flash memory card and dual core DVD drive.

- 1.2.8.2.3 Interactive type operation with guided message on 15" LCD panel display monitor, thus needing minimum operator experience required for programming and machine. Alpha numeric display with graphics. It should display all functions in real time including tool path and actual tool positioning.
- 1.2.8.2.4 Facility for data input via USB PORT/FLASH MEMORY CARD and dual core DVD Drive. To be housed inside a dust proof compartment.
- 1.2.8.2.5 More than 100 standard programmers of EPROM for reducing operator's programming time.
- 1.2.8.2.6 Part rotating, shifting and mirror imaging functions.
- 1.2.8.2.7 Kerf compensation up to $\pm 15\text{mm}$ in 0.1mm increments.
- 1.2.8.2.8 Acceleration and deceleration control salient point angle analysis & monitoring the contour & corners in order to ensure the cutting quality.
- 1.2.8.2.9 Point to point digitizing for linear and circular interpolation.
- 1.2.8.2.10 Job recovery capability
- 1.2.8.2.10.1 Return to programme starting point.
- 1.2.8.2.10.2 Return to original piercing point.
- 1.2.8.2.10.3 Jog operation in programme path or torch maintenance or service.
- 1.2.8.2.10.4 Resuming
- 1.2.8.2.11 The control should have facility of fully floating datum.
- 1.2.8.2.12 The control should have provision for automatic recognition of ISO/EIA/DXF/ESSI & robos codes. To include drawing codes.
- 1.2.8.2.13 The programming should be possible both in FPS system and MKS system i.e. in inches as well as in mm.
- 1.2.8.2.14 Cutting condition programme selection (A table with data for cutting speed, kerf width, pre-nesting time etc. depending upon plate thickness and material).
- 1.2.8.2.15 X/Y movement manually by means of coordinated push buttons/joy sticks.
- 1.2.8.2.16 Capability for DNC communication interface with programming centre for production control.
- 1.2.8.2.17 Fixed programmers and the auxiliary functions.
- 1.2.8.2.18 Auto crates shape programs from existing cad files
- 1.2.8.2.19 The control should have exclusive full shape automatic nesting software and networkable remnant plate stock handling data base. It should be possible to load this nesting software on the offline programming station.
- 1.2.8.2.20 Standard RS-232 connector.
- 1.2.8.2.21 Retractable standard keyboard and separate external terminal for PS/2 PC keyboard.
- 1.2.8.2.22 Storage capacity for programmers with rapid access to main/part programmers for any modification etc.
- 1.2.8.2.23 Absolute and incremental programming.
- 1.2.8.2.24 Control over torch pilots and X-Y movement of torch etc.
- 1.2.8.2.25 UPS for retaining memory during power failure for minimum 30 minutes back up time. The battery shall be of low/no maintenance, long life and shall last for atleast two years.
- 1.2.8.2.26 The controller shall be dual microprocessor system of reputed make such as Intel etc.

- 1.2.8.2.27 The system should be able to program online on the machine itself in both absolute and incremental mode, with option to nest the shapes.
- 1.2.8.2.28 The free contour programming should be flexible enough with at least 6 options each for drawing lines, arcs, circles and points.
- 1.2.8.2.29 Separate external monitor connection. (in case of system monitor failure).
- 1.2.8.2.30 Separate external mouse connection in addition to existing one.
- 1.2.8.2.31 The control system should be such that, the job could be processed from the middle of the program in case of power failure or interruption, instead of resetting and starting from zero point. Besides it should be able to accept online programming of free contours.
- 1.2.8.2.32 All the wire in the control panel shall be numbered and tagged with ferrules.
- 1.2.8.2.33 Automatic portal control to absolute rectangular & reference points with respect to drives and sensors.
- 1.2.8.3 Complete self diagnostics system for rapid fault detection. However, the following functions are expected:
 - 1.2.8.3.1 Fault, its status, indication and logging
 - 1.2.8.3.2 Analysis of fault condition, providing information on its nature and reasons thereof.
 - 1.2.8.3.3 Continuing monitoring of machine operation, detection of abnormal conditions, initiation or corrective action and recording the condition of machine at the time of fault through transducers suitably placed at various locations on the machine with 'fail safe' devices which under abnormal conditions are required to prevent damage to the machine.
 - 1.2.8.3.4 Provision of adequate and correct information to enable appropriate action regarding repair and operation of the machine being taken in time.
- 1.2.8.4 Interactive graphics with programmer simulation and dry run capability on 15" inch (minimum) LCD screen. Alfa numeric display with graphics. It should display all functions in real time including torch path and actual torch positioning. Cutting point moving indication should also appear on the screen. LCD display 8-line x 40 character (LCD graphic display) Graphical display screen should be provided. The screen will have capacity of editing through cursor control. The graphic screen provided with CNC control should have facility of carrying out nesting of sheets.
- 1.2.8.5 Provision of auto-piercing cycle.
- 1.2.8.6 Dust proof air conditioning cabinet for housing of CNC controls has to be provided.
- 1.2.8.7 The drive amplifiers should be mounted in a separate dust proof housing. The electrical circuits should be provided on printed circuit board. The process control, the operator control panel and the CNC should be integrated into the cabinet. The enclosures should be of IP-50 class. The entire electronics of the control system should be housed in a dust proof air-conditioned cabinet. All circuits must be tropicalized.

2. GENERAL ELECTRIC SPECIFICATION:

- 2.1 The provision of this General Specification shall apply, where ever relevant.
- 2.2 All equipments and material shall comply with appropriate Indian Standards (latest), International Standards or National Standards of the country of origin provided the latter are equivalent to or better than the former. The tenderer shall indicate the Standards applicable. The following standards are applicable in particular.
(Corresponding International Standards like ASA, NEMA, BIS, DIN etc. may also be quoted).

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- IS : 325-1979 (latest) - Three phase induction motors (corresponding to IEC pub-34-1) (Latest).
 - IS : 1248 (Latest) - Direct acting indicating analogue electrical measuring instruments and their accessories (corresponding to IE Pub-51) (Latest).
 - IS : 1231-1974 (Latest) - Dimensions of three phase induction motors (corresponding to IEC Pub-72-1) (Latest).
 - IS : 1271-1985 (Latest) - Classification of insulation material for electrical machinery & apparatus in relation to their thermal stability in service (corresponding to IEC-Pub-85) (Latest).
 - IS : 6875 (Latest) - Push Buttons and related control switches corresponding to IEC Pub/73) (Latest).
 - IS : 375-1963 (Latest) - Marking and arrangement of switch gear, bus bars, main connection & auxiliary wiring.
 - IS : 996-1979 (Latest) - Single phase small AC and universal electrical motors.
 - IS : 1356 (Latest) - Electrical equipment of machine tools.
 - IS : 2516(Latest) - Circuit breakers (corresponding to IEC Pub-56) (Latest)

2.3 Unless specified in the main specification, the AC motors and starters shall be of the following type. Tenderer is, however, free to give alternative proposal along with justification, if in his view alternative proposal is warranted by site conditions. Type of motor type of starter.

TYPE OF MOTOR

TYPE OF STARTER

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| 2.3.1 | Any type of AC motor starting current of which does not exceed 75 amps. | Direct on line. |
| 2.3.2 | AC squirrel cage, induction motors, starting current of which is above 75 amps if started direct on line | Star delta or Auto transformer type. |
| 2.3.3 | AC slipring type motor | Resistance type air/fan Cooled |
| 2.3.4 | AC synchronous or synchronous induction motor. | Suitable makers standard. |
| 2.3.5 | DC motor | Resistance type/Thyristor type. |
| 2.4 | The control gear for AC/DC motors shall incorporate the following protection devices as concomitant accessories. | |
| 2.4.1 | No Voltage Protection - No voltage protection shall be provided so that machine will not start up again by itself when, following an interruption the supply is restored. | |
| 2.4.2 | Short Circuit Protection - To protect against short circuits due to insulation failure of faulty connections HRC fuses shall be provided for each motor. The rating of the fuse shall be such as to take care of the over current due to motor starting. | |
| 2.4.3 | Over Load Protection - To prevent motors from overloading, overload protection shall be provided separately for each motor. Three phase motors shall be | |

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protected by overload tripping devices on each phase.

- 2.4.4 **Single Phasing Protection** - A separate current sensitive delayed action single phasing preventor shall be provided for each motor separately. Overload protection shall not be treated as single phasing preventor.
- 2.5 Control equipment shall be mounted in separate drip proof enclosures. Control enclosures and compartments are to be so designed as to give adequate protection against ingress of dust, oil, coolant or chips. All control devices like contractors etc. shall be front mounted on a rigidly fabricated metal panel for ease of operation. All other electrics shall be installed that they are readily accessible when the doors and covers are opened. Hinged covers shall be interlocked with the machine tool control to prevent operation of the machine when cover is open.
- 2.6 The motor shall be totally enclosed with or without fan cooled frame. Screen protected drip proof type motor may be provided if it is mounted inside protective enclosures.
- 2.7 The electrical equipments shall comply with the requirement of Indian Electricity Act and Rules (latest).
- 2.8 All instruments shall be of the Industrial Grade "A" (IS-1248) switch board type the range of the instrument shall be such that the maximum load expected in the circuit shall produce a deflection of 60% to 80% of the full scale.
- 2.9 The supplier shall furnish 3 sets of complete electrical and electronic wiring diagrams in full details to enable the maintenance staff to locate faults in the circuits, 3 sets of part catalogues, maintenance manuals operating instructions with details of coils and windings, used in the equipment to facilitate repairs and maintenance should also be supplied.
- 2.10 For main motor class minimum "B" Class insulation shall be provided. If any other class of insulation is proposed, detailed justification for providing different class of insulation shall be given.
- 2.11 Motors shall be designed to withstand frequent starts, stops and reversals as demanded in the operation of the machine
- 2.12 Two earthing terminals shall be provided on all electric motors including the control gear.
- 2.13 **POWER SUPPLY:**
- 2.13.1 The machine shall be suitable for operation on 415 volts 3 phase 50 cycles AC 3 wire or 4 wire system with neutral solidly earthed. The supply voltage may vary up to +10% -20%. The frequency may vary up to $\pm 3\%$. However, full rated power of the motor shall be available at the lower voltage. Firm should confirm satisfactory performance of the machine at incoming power supply in the range 415V+10%-20% and 50HZ $\pm 3\%$ frequency or should provide voltage stabilizer as specified against clause 2.13.2 below of required capacity.
- 2.13.2 The voltage stabilizer, if required, shall conform to :
- | | | | |
|----------|--------------------|---|---|
| 2.13.2.1 | Input Voltage | - | 320 to 460 volts 3 phase 4 wire supply. |
| 2.13.2.2 | Out put Voltage | - | 415 volts |
| 2.13.2.3 | Regulation | - | $\pm 1\%$ from No load to Full load. |
| 2.13.2.4 | Rate of correction | - | 20 volts per second per phase. |

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- 2.13.2.5 Wave form distortion - NIL
 - 2.13.2.6 Efficiency - Not less than 97%.
 - 2.13.2.7 Winding and class of insulation - Copper wire wound with "B" class of insulation or better.
 - 2.13.3 In case of machines equipped with NC, SS, CNC, Thyristor controlled devices and other sophisticated electronic gadgets including microprocessors etc. which are susceptible to power line spikes and surges, a suitable voltage stabilizer and ultra isolation transformer of adequate capacity to cover for the entire electrical load of the machine shall be offered as a concomitant accessory conforming to Specification for voltage stabilizer as mentioned in clause 2.13.2 above and isolation transformer to the parameters mentioned below.
 - 2.13.3.1 Transformer ratio - 1:1
 - 2.13.3.2 Winding - Copper wire wound with "F" class insulation or better.
 - 2.13.3.3 Protection - To arrest spikes and surges to the order of 3 KV for 200-400 micro seconds duration.
 - 2.13.3.4 Common mode rejection ratio - 120 dB
 - 2.13.3.5 Isolation - Capacitance 005 Pf: resistance greater than 1000 Mega Ohms.
 - 2.13.4 Voltage stabilizer shall be equipped with a protective relay to trip the AC power supply to the machine instantaneously with audio and visual indication to the operator. Settings of the protective relay for low and high voltage shall be 320 volts and 460 volts respectively.

2.14 ATMOSPHERIC CONDITIONS

- 2.14.1 The ambient temperature at the site at which the machine will be installed may vary from -4°C to +50°C over the year. The relative humidity may be as high as 98%. The atmosphere is expected to be dusty. The machines offered shall be suitably tropicalised to work under these atmospheric conditions without any adverse effect on their performance.
- 2.15 The temperature rise shall not reach such a value that there is a risk of injury to any insulating material or adjacent parts.
- 2.16 The drive shall be capable of operating at any one of the speed required independent of the load in accordance with the requirements of the machine.
- 2.17 Information/data shall be furnished as per the format of submission of technical bid Annexure-A of Section - III.

3. GENERAL CHARACTERISTIC:

3.1 RIGIDITY AND STABILITY

- 3.1.1 The machine shall be robust, rigid and of sturdy construction. It shall be designed to meet heavy duty demands of various operations on the machine under normal Workshop environment for such machines. It shall be free for vibrations even when working at full capacity.
- 3.1.2 All machine castings shall be made of close grained high grade cast iron like Meehanite or equivalent materials meeting IS-210 Standards to ensure durability and rigidity. The casting shall be thermal stress relieved to ensure stability and continued accuracy.

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- 3.1.3 All machine fabrications of critical load bearing assemblies like beds, columns etc. shall be adequately strengthened and stress relieved.
- 3.1.4 Change in ambient temperature shall not affect the performance of the machine.
- 3.1.5 There shall be no change in the performance of the machine either on switching on the machine or after continuous running.
- 3.1.6 There shall be no resonant vibrations throughout the working range of the machine at all load levels.
- 3.2 SAFETY CONTROLS**
 - 3.2.1 The machine shall incorporate safety devices to provide protection to the operator and machine against all possible operational and machinery failures.
 - 3.2.2 Suitable interlock shall be provided to prevent machine operations in the event of
 - 3.2.2.1 Faulty sequence of operation.
 - 3.2.2.2 Fluctuation in supply voltage.
 - 3.2.2.3 Resumption of power supply after power failure.
 - 3.2.2.4 Non-positioning of safety guards.
 - 3.2.2.5 Failure of hydraulic system (where applicable)
 - 3.2.2.6 Failure of lubricating system (In case of automatic including drop in pressure lubrication)
 - 3.2.3 A fault or damage in the control circuit or interruption re-establishment after an interruption of fluctuation in whatever manner in the power supply to the machinery must not lead to dangerous situations in particular.
 - 3.2.3.1 The machinery must not start unexpectedly.
 - 3.2.3.2 The machinery must not be prevented from stopping if command has already been given.
 - 3.2.3.3 No moving part of the machinery or piece held by the machinery shall fall or be ejected.
 - 3.2.3.4 The protection devices must remain effective.
 - 3.2.4 The machine shall be fitted with an emergency stop device to enable actual or impending danger to be averted. This device must be:-
 - 3.2.4.1 Conveniently located.
 - 3.2.4.2 Clearly identifiable.
 - 3.2.4.3 Stop the machine as quickly as possible without causing additional hazards.
 - 3.2.4.4 The emergency stop must remain engaged. It should be possible to disengage it only by appropriate operation. Disengaging the control must not restart the machinery but only permit restarting.
 - 3.2.5 Safety features shall also include.
 - 3.2.5.1 Safety device against overload for all mechanical and electric items to the extent possible.
 - 3.2.5.2 Safety stops against over-running of slides
 - 3.2.6 Guard and protection devices shall protect exposed persons against risks related to moving transmission parts (such as pulleys, belts, gears, rack and pinion, shafts etc.) and moving parts directly involved in the process to the extent

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