

Specifications of Inverted Rotary Swaging Machine

➤ **SCOPE:**

Design, fabrication, supply, installation, commissioning, prove out and training of Custom built Inverted Rotary Swaging Machine at VSSC/ISRO, Thiruvananthapuram-695022, as per the following specification:

- **End use:** Swaging of tubular work piece
- **Work piece:** It is defined as tube of Lead/ Lead Antimony/ Tin-Antimony with smooth surface having hazardous high energy crystalline powder filled inside.
- **Circular Swaging: Initial Swaging of work piece to reduce diameter**

Work piece starting geometry	: Circular (Tube)
Work piece starting tube length	: 550 mm (min.)
Work piece starting tube dia.	: 23 mm maximum
Work piece final diameter	: 4 mm
Work piece dia. reduction steps (Refer annexure 2)	
Work piece dimensional tolerances	
Tolerance on external diameter	: ± 0.12 mm
Tolerance on roundness	: ± 0.12 mm
Tolerance on Shaped product (V geometry)	: ± 0.12 mm
- Swaging of the both end crimped work piece (having hazardous high energy crystalline powder filled inside the tube) has to undergo diameter reduction in steps as mentioned in Annexure 2.
- **Shaping by swaging:** to achieve 'V' configuration as per sketch attached in annexure 2.
- The design of the Die set for both circular and non circular shape including size, stroke, kinematics for die/striker etc shall be in the scope of the supplier. Drawing of Shaping die set internal profile will be provided by VSSC.
- Final length of the product will be 8.5 m approx (For 4 Dia.).

SPECIFICATIONS OF THE MACHINE:

High precision in-feed, Inverted Rotary Swaging Machine with the following features;

- Both Spindle and Main housing rotating opposite to each other.
- Speed of both Spindle and Main housing shall be controlled from control panel.
- Variable Frequency (Speed) Drive (VFD) / Geared Motors shall be used for rotation of Outer Ring (having hammer rollers) and Spindle Flywheel (Having die set)
- **Circular Profile Swaging:** Both Spindle flywheel and Outer Ring rotating opposite to each other
- **Non-Circular Profile Swaging:** For non circular shape swaging, provision of locking the Spindle Flywheel (having die sets) by suitable locking lever mechanism shall be provided.
- The total power drawn by the machine shall be max. 10 KW.
- Dimension of the machine: 1800 x 1200 x 1200 mm (L x W x H) approx.
- In-feed Roller to Out-feed roller: 550 mm, Max.
- Weight: 1000 kg approx.
- Size reduction: 23 mm to 4 mm (As per Anneure-2)
- Die size: 35 x 40 x 50 mm. (H x W x L) approx. , Material- HSS
- Outer Ring Motor: 3 HP, 3 phase Flame proof type, Suitable for Class IIA or IIB or IIC Hazardous area, Temp class : T5 (100 deg C max.) and with min IP 55 protection.
- Spindle Motor: 3HP, 3 phase Geared motor, Flame proof type Suitable for Class IIA or IIB or IIC Hazardous area, Temp class : T5 (100 deg C max.) and with min IP 55 protection.
- Feeder Motor (At both sides): 0.25 HP, 3 Phase, Geared motor, Flame proof, Suitable for Class IIA or IIB or IIC Hazardous area, Temp class : T5 (100 deg C max.) and with min IP 55 protection.

DETAILED SPECIFICATION IS AS PER SECTION 1 TO 5.

1.0 WORK PIECE IN-FEED SYSTEM

- 1.1 The feed system should have high precision guiding of the work piece
- 1.2 The axis of in-feed should be perfectly and absolutely aligned to center of the die.
- 1.3 Feeder should be of roller type.
- 1.4 The feeding mechanism should have In-feed rollers and Out-feed roller
- 1.5 In-feed Roller will feed the work piece to the machine and subsequently after guiding the work piece from machine, Out-feed roller will take the work piece to the process channel/ process bed.
- 1.6 A suitable guide mechanism shall be provided to feed the tube from in-feed roller to die set and at out-feed side from die set to the roller unit.
- 1.7 Speed of feeding the work piece (Feed rate) should be variable (0.2 to 0.6 m/min.) and provision shall be there to regulate it from the control panel.
- 1.8 Distance between In-feed roller to Out-feed roller shall be 550 mm approx.
- 1.9 Feeder roller should be made of soft material like rubber/Lined with rubber (75 to 85 Shore A) to provide required sufficient gripping of the work piece for feeding, at the same time should not crush the work piece.
- 1.10 Roller pairs should have gap to hold the work piece.
- 1.11 Suitable size Roller pairs to be provided to accommodate the work piece at each step of swaging (as per Annexure-2).
- 1.12 The clamping force on the work piece should be adjustable.

2.0 SWAGING HEAD AND DIES

- 2.1 **Die Configuration:** Two Die configuration for both shaping and circular swaging
- 2.2 Swaging machine should be double rotating type, i.e., Rotating spindle and rotating outer ring in opposite direction. The relative rotation between spindle flywheel and outer ring shall not transmit torque to the work piece.
- 2.3 Speed of the Spindle flywheel shall be 50-100 rpm (variable and controlled type)
- 2.4 Speed of the Outer Ring shall be 150 to 250 rpm (variable and controlled type)
- 2.5 Speed of the Outer Ring and Spindly flywheel should be regulated/ Set from the control panel

- 2.6 Party has to design the speed of flywheels as per our requirement of processing the work piece as per Annexure-2 meeting safety in processing of hazardous high energy crystalline powder filled tube swaging and meeting the tolerance specification of the product at each step of processing.
- 2.7 Motor for Outer Ring Flywheel: 3 HP, 3 phase Flame proof type Suitable for Class IIA or IIB or IIC Hazardous area, Temp class : T5 (100 deg C max.) and with min. IP 55 protection.
- 2.8 Motor for Spindly Flywheel: 3 HP, 3 phase Geared motor, Flame proof type Suitable for Class IIA or IIB or IIC Hazardous area, Temp class : T5 (100 deg C max.) and with min IP 55 protection.
- 2.9 Motors to respective flywheels shall be connected by belt drive mechanism.
- 2.10 The swaging operation to reduce the dia. shall be done in steps, each step involving precision in feeding of the work piece material. The diameter reduction steps are given in Annexure 2. Each step involving precision in feeding of the work piece.
- 2.11 The radial oscillatory motion of the dies shall be simultaneous and synchronized.
- 2.12 Stroke length of the swaging dies should be adjustable. This can be by using a key/shim or by equivalent standard mechanism.
- 2.13 For circular swaging, the swaging dies shall move around the work piece, and for non circular swaging, the swaging dies shall be stationary.
- 2.14 Swaging process (shaping or circular swaging) shall not result in longitudinal burrs (fins) on the work piece.
- 2.15 There should not be any slip/ rotation/ twist of the work piece during swaging.
- 2.16 There should not be any slip between the roller and strikers during swaging.
- 2.17 The design of the Die set for both circular and non-circular shape including size, stroke, Die profile, Striker, Shim etc shall be in the scope of the supplier.
- 2.18 Swaging Die's should be made of (High Speed Steel) HSS, Tungsten carbide or equivalent material. Hardness of the Die set should of 45 RC (min.) with approx. dimensions of single die 35 x 40 x 50 mm. (H x W x L).
- 2.19 Party shall specify the die material and die size. The die assembly area, tube swaging area and swaged tube output area in the machine shall be such a way that it should be easy to disassemble and clean for any powder spillage.

3.0 WORK PIECE SUPPORT

- 3.1. The machine shall be equipped with the necessary provisions to give support to the work piece (both at the in-feed side as well as the out-put side).
- 3.2. The frame/Channel at the Input and output side should be rigid enough to support the flexible work piece. (Material MS with powder coating painting)
- 3.3. The support frame should be detachable type (1 m segments) with suitable stands.
- 3.4. Assembly Length of the frame should be of 9 m at both ends.

4.0 CONTROL SYSTEM

- 4.1 Full technical details of the control system shall be provided with the offer.
- 4.2 Control panel has to be positioned (max.) 25 m away from the swaging machine.
- 4.3 Electrical armored cable- FRLS type (Fire Retardant Low Smoke) connection shall be provided from control panel to the machine.
- 4.4 The different modules of the control system shall be of reputed make (Like SIEMENS, SINUMERIK, SIMATICS, SINAMICS or equivalent)
- 4.5 All the Modules are to be housed inside the cabinet.
- 4.6 Full details of the make, model and rating of all the components used in the system shall be provided.
- 4.7 Interlocks required for safety operation to be provided.
- 4.8 The power panels and the control panels shall be capable of being locked out during maintenance to prevent inadvertent operation. All power isolation points shall be identified and labeling shall be provided. Voltage, Current indicator to be provided on the control panel.
- 4.9 START, STOP, Emergency Switches shall be clearly labeled on control panel. Earth leakage (30mA) and over load circuit breakers shall be provided which will Automatically disconnect the supply

5.0 SOUND REDUCTION ENCLOSURE – (Detachable Type)

- 1) Party has to design a sound reduction enclosure for the machine.
- 2) Noise level during swaging should be less than 75 dB at outside of the enclosure
- 3) The enclosure should be fabricated structure of modular construction.

- 4) The fabricated structure should be made of Rectangular pipes-ERW (Electrical Resistance Welding).
- 5) Three nos. of doors & four nos. of viewing window shall be provided for easy access
- 6) The viewing windows should be provided with Poly Carbonate (PC) Sheet.
- 7) There should be Perforated Sheet in the inside of the enclosure and outside should be of plain sheet.
- 8) Rock wool should be sandwiched between two sheet of metal panels to dampen the noise level
- 9) PC sheet doors should be provided on both sides to view the operation
- 10) Air vent with blowers should be provided. (2 nos.)
- 11) Party has to successfully install the Noise Reducing Enclosure.
- 12) With enclosure, sound level should be less than 75 dB when the machine is in operation.

6.0 GENERAL TECHNICAL POINTS

- 1) **Emergency switch** (Pressing type) shall be provided at both the sides of the Machine and in the control panel
- 2) The electrical system shall be designed for 3 phases, 415 Volt, 50 Hz.
- 3) Respective Motor capacity shall be 1.25 times than the max. load required. (Ensuring max. 80% of Motor capacity utilization)
- 4) The electrical system shall be design to follow the relevant Indian standards incorporating mandated safety requirements. All the components of the system shall be of reputed make.
- 5) Full details of the system, circuit diagrams, make and model of the components, Drives, Motors shall be provided with the offer.
- 6) The total power drawn by the system shall be indicated.
- 7) The electrical system shall be housed in cabinets, with proper layout and with clear markings corresponding to the circuit diagrams.
- 8) Party shall provide the layout of the machine including foundation requirements.
- 9) All bought out items shall be from known reputed brand.

- 10) Flame proof electrical systems, Suitable for Class IIA or IIB or IIC Hazardous area, Temp class : T5 (100 deg C max.) and with min. IP 55 protection shall be used
- 11) Tools: One Set of maintenance tools and any special tools required for the regular operation shall be supplied along with the machine.
- 12) One intrinsically safe sensor shall be placed near the die fixing area shall be interlocked such that the machine cannot be started when the die changing/ maintenance is in progress
- 13) All access to dangerous moving parts, or danger zones created by the equipment, been prevented by the provision of the correct guards, interlocks and/or barriers.
- 14) The equipment shall be provided with a clearly identified means to securely isolate it from all energy sources.
- 15) Sequence of operations documentation shall be provided clearly mentioning the operating limits and procedures
- 16) Instrument index shall be prepared & supplied
- 17) Instrument loop diagrams shall be prepared and supplied
- 18) Interlock descriptions shall be properly mentioned & supplied
- 19) Document on operation and maintenance procedure shall be provided by the supplier
- 20) Necessary trials shall be carried out to achieve the specification during PDI & installation.
- 21) Any minor modification required to meet the specification shall be done free of cost.
