Mg-2

TECHNICAL SPECIFICATION FOR "CUSTOM DESIGNED MINI TWIN-ROLL CASTING EQUIPMENT"

About the equipment:

This will a custom designed integrated equipment for the strip manufacturing of Magnesium (Mg) and its alloys. This equipment combines the features of ultrasonic based casting and rolling method together to get Mg alloy strip in a single step process. Developed strip will be used further for sheet development through various rolling based thermo-mechanical processes.

Essential Features:

- The equipment should have capabilities of manufacturing strips of magnesium based alloys and composites
- The equipment should be designed in such a way that the all processes/experiments can be carried out in complete inert environment.
- The required specifications are tabled as following:

Technical Specifications:

Sl. No.	Part/Feature	Description
1.	**Bottom Pouring Type Stir Casting Unit**	
1.1	**Retort**	The retort holds the molten metal. **Material:** Should be made of highly corrosion resistant and heat resistant material. **Protective Sleeve:** A replaceable sleeve should be provided inside the Retort to protect from wear and tear while stirring at high temperature **Non-Stick Coating:** High temperature non-stick coating (graphite based) should be provided along with the machine. This must be applied to the protective sleeve. The non stick coating must be sufficient enough for at least five years. **Capacity:** 500 gms to 2 Kg of Magnesium and its alloys **Heating System:** Maximum Temperature: **950 °C or more** Heating Element: **KANTHAL APM Coils** Heating Chamber: Should made of high temperature muffle constructed with high temperature withstanding refractory Insulation: High density ceramic fiber
1.2	**Bottom Pouring**	• Gate valve should be controlled by Permanent Magnet DC Motor with reduction gear box • Gate valve should auto stop at OPEN & CLOSE Position
1.3	**Outer Shell**	• **Shape:** Should be cylindrical and made of thick gauge mild steel sheet.

1.4	**Stirrer Arrangement**	• **Blade** **Type:** Twin Fin blade **Material:** Stainless Steel 310 grade or better • **Speed:** Variable from 100 to 1500 RPM Motor: **Permanent magnet DC Motor** Speed control: **Using DC Drive with 4 to 20 mA control** Indication: **Digital indication & control with accuracy of +/- 10 RPM** **Lift:** Type: Motorized Lift Auto cut off at extreme TOP & BOTTOM. **Auto LIFT:** This facility should allow user to lift the stirrer UP/DOWN while stirring automatically
1.5	**Pre-heating furnace for reinforcement (Powders)**	• Should be attached in top of the Stir Casting Furnace • Heating chamber made of high quality material tube should be provided with a gate valve at the bottom • Gate valve should be provided to control the flow of reinforcement into the melt. **Heating System:** Maximum Temperature: **800 °C** Heating Element: **Nichrome Wire** Heating Chamber: should be made of high alumina tube constructed with high temperature withstanding refractory Insulation: High density ceramic fiber **Outer Shell** **Shape:** Cylindrical S.S polished tube
1.6	**Pre-heater for Mould**	• Immersion type mould/die preheater should be provided along with the machine • It should be portable and easy to handle • Max. Temperature: 450 °C or higher.
1.7	**Inert & Gas Mixing System**	• Ar gas should be provided as input for maintaining Inert Gas Atmosphere • SF6 should be provided as input for maintaining the temperature in case if the temperature shoots up because of firing of Mg or any flammable materials added in the melt. • Separate S.S gas storage tank should be provided to store the input gases at the set pressure • Digital gas mixing controller should be provided to mix the input gases to required ratio (0 to 100%) • Digital mass flow controller should be provided for the mixed gas output to the combustion chamber. The gas flow can be adjustable from 0 to 10 LPM. • A gas shield should be provided around the bottom pouring tube to avoid the flashing of Mg while pouring into the die.

2.	**Ultrasonic Vibrator**	**Type** : Ultrasonic Liquid Processor **Ultrasonic Power** : 2500 Watts with power adjustment of 60%, 70%, 90% & 100%. **Ultrasonic Frequency:** 20 KHz **Horn Diameter** : 30 mm • Inclusive of Convertor, Booster and Titanium tipped probe with full wavelength horn nearly of 250 mm for equal particle dispersion of molten Aluminium & Magnesium • Motorized lifting arrangement for Horn with Auto cut OFF at extreme TOP & BOTTOM. • Water Cooling arrangement should be provided to cool the ultrasonic horn **Accessories to be provided:** Portable trolley with rigid frame structure to move this setup for dipping the ultrasonic probe into the stir casting machine.
3.	**Water cooling tower**	• Fan: 1 HP 3 Phase Motor (or higher capacity) • Water Pump: 1 HP submersible pump for recycling of water • Body should be fabricated with FRP material. • Necessary water hoses, clamps and etc should be provided.
4.	**Vertical Twin Roll Casting setup**	
4.1	**Type**	Vertical Casting Setup
4.2	**Melt Reservoir**	Melt from the Bottom Pouring Type Stir Casting Machine will be collected & stored in this chamber. **Furnace:** Max. Temperature: 1000 °C (or more) Heating Element: Kanthal APM Insulation: Ceramic fiber Inner Chamber: Made of alumina Temperature indication and control: digital, using HMI software. **Reservoir Chamber:** This holds the molten metal. **Material:** Made of mild steel **Capacity:** 500 gms to 2 Kg of Magnesium **Pouring System:** Type: Motorized, controlled from HMI software Gate valve activated with PMG DC motor. **Distributor Chamber:** Fitted below the reservoir chamber • The distributor guides the molten metal to flow evenly into the roller gaps. • The width of the distributor mouth should be variable to attain different casting dimensions. 40 mm, 1 no 60 mm, 1 no 80 mm, 1 no 100 mm, 1 no **Atmospheric Control:** • Inert atmosphere should be maintained inside this retort to avoid oxidation of Magnesium.

		• Gas shield below the distributor tube should be provided to avoid contact of outer atmosphere with melt while transferring the melt into the roller.
5.	**Rolling Unit** (Type-2 Hi)	
5.1	**Roller Material**	• EN18 steel, heat treated and hardened or better material. • Hot chrome coating should be provided on the outer surface
5.2	**Roller Dimensions**	Each Roller: 300 mm dia and 200 mm long
5.3	**Roll Gap**	Max. gap: 8 mm Min. gap: 0.5mm
5.4	**Shear Blades**	Shear blades should be provided on the output side of both the rollers to release any sticky materials on the roller.
5.5	**Drive**	**Motor:** • Should be coupled to one roller • Another roller will be driven using the gear which should be connected to the motor driver. **Motor:** Make: Crompton Greaves or better reputed make Load: 22KW / 30 HP or higher Phase: 3 Ph A.C motor Max. Speed: 1440 RPM or more Type: Foot mounted **Reduction Gear Box:** Output RPM: 21.4 or better Output Torque: 15200 NM Mechanical rating: 43.8 kW @ 1500 RPM input Service Factor: 2 **Motor Speed Control (Using variable frequency drive)** **Input Range** VAC: 380 to 480 Volts AC, 3 phase Frequency: 50 Hz Rated current: 45 Amps **Output Range:** Voltage: 3 phase AC 0 to input voltage Output frequency: 0.00~400.00Hz Over load capacity: 150% of rated current Frequency control: from ECS Panel.
5.6	**Speed and control**	• Speed: 0 to 20 RPM (Variable) • Digital indication of roller speed (in RPM) and control should be provided.
5.7	**Load on Roller**	• Max. Load: 100 tons (or higher) • Digital indication of load using load cell.
5.8	**Frame**	• Heavy mild steel frame • Rollers should be enclosed with removable covers to maintain the atmosphere

6.	**Control Panel: Human Machine Interface (HMI)**	
6.1	**Software Indication, Control & Recorded Parameters**	Following Controls and Displays should be provided: 1. Bottom Pouring Type Stir Casting Machine **a.** Actual Melt Temperature **b.** Reinforcement Temperature **c.** Mold Temperature d. Stirrer i.Speed indication & control +/- 10 RPM ii.Stirrer vertical height control with auto cut off at extreme top & bottom e. Bottom Pouring Gate Valve Control (OPEN/CLOSE) f. Controlled Atmospheric Control 0.SF6 & Ar gas mixing percent (0 to 100%) 1.Gas Pressure Control 2.Gas Flow Control: 0 to 10 LPM 2. Ultrasonic Vibrator Vibrator ON/OFF Vibrator lift UP/DOWN control 3. Water Cooling Tower Water Temperature Water PUMP ON/OFF Cooling FAN /ON/OFF 4. Vertical Twin Roll Casting setup Melt reservoir temperature indication and control Roller speed adjustment and control Roller height indication and control Load indication and control Gas flow control Rolling water cooling indication and control
6.2	**Temperature Sensors Used**	• All the temperature sensors used should be K Type thermocouple which are sheathed with S.S 304 grade steel and grounded at the tip for better accuracy. • Necessary pressure transducers, load cell and strain gauges should be provided to indicate the load and displacement respectively. • All heaters should be controlled by the HMI with PID based logic to attain a great control accuracy of +/- 1 ^{0}C.
6.3	**Other control Accessories:**	• Digital VAF meter should be provided to indicate the power, current and voltage consumed by the machine. • Power control through Solid State Relays • Necessary HRC Fuse should be provided
7	**Essential Accessories & Spares to be supplied along with the machine**	
7.1	**Laptop/Desktop**	Latest Configuration with necessary custom designed HMI software and

		wireless interface (1 no)
7.2	**Tool Box**	With all necessary wrenches, pliers etc. (1 set)
7.3	**Machine Cleaning Tool Kit**	With all necessary cleaning tools (1 set)
7.4	**Machine Spares**	1. S.S Stirrer Blades (5 nos) 2. Temperature Sensors (10 nos) 3. High temperature nonstick coating (750 gms, 10nos) 4. High temperature Safety gloves (4 pairs) 5. Titanium tipped SS probe or ultrasonic vibrator (2 nos)
7.5	**Controlled atmosphere spares**	1. Gas Cylinder filled with SF6 gas (2 nos) 2. Gas Cylinder filled with Ar gas (2 nos) 3. S.S Double stage regulators for the above (2 nos)
8	**Optional Spares to be supplied for maintenance after warranty (Should be quoted separately)**	

8.1

S.No	Description	Qty
I.	**Spares for Stir Casting Machine**	
	a. Heating Chamber	2
	b. Preheating (Reinforcement) Chamber	2
	c. Die heaters	6
	d. Retort (S.S 310 grade)	3
	e. Protective sleeve for retort	10
	f. Temperature Sensor: for Heating Chamber	5
	g. Temperature Sensor: for Melt	20
	h. Temperature Sensor: for Preheater (Reinforcement)	5
	i. Temperature Sensor: for Mold	10
	j. Stainless Stirrer Blades	50
	k. Bottom Pouring Setup	3
	l. High Temperature Non-Stick Coating, 750 gms pack	20
II.	**Spares for Ultrasonic Vibrator**	
	a. Titanium tipped S.S probe	1

	III.	**Spares for Vertical Twin Roll Casting**		
		a. Heating Chamber	2	
		b. Reservoir Chamber	2	
		c. Temperature Sensor: for Heating Chamber	5	
		d. Temperature Sensor: for Melt	20	

	OTHER TERMS and CONDITIONS	
9	**Warranty period**	24 months from the date of installation/commissioning.
10	**AMC**	Additional AMC should be provided for 3 more years.
11	**Installation**	Installation should be done by factory trained engineers at our site, free of charge.
12	**GST**	Offer should be made @ 5 % GST against concessional GST certificate.
13	**Delivery condition**	Equipment to be delivered in test ready, factory calibrated condition. Equipment should be delivered within two months from the date of purchase order release.
14	**Compliance statement**	Compliance statement needs to be provided clearly specifying COMPLY/NON-COMPLY with remarks of all of the points mentioned above.
15	**Spare Parts** (As mentioned in Sl No. 8 above)	The supplier should provide all the consumables, accessories and spares for at least 5 years. The price for individual consumables/accessories/spares for 5 years should be quoted separately. The customer will select the consumables/accessories/spares as per the budget availability.
16	**Capability**	The Vendor must have supplied any kind of rolling mill or costing unit to atleast 2 NIT's or 2 IIT's.