1. Specification for Outer Assembly Table and Inner Mandrel Table (with Motorized Mandrels) FOR 270MW and 150MW LAMINATIONS

Description:

Outer assembly table and inner mandrel tables are required for a robotic technology process that will pick up the laminations from pick-up table (de-stacking) and place (assemble) it in a circular manner on a circular assembly table (outer table) as shown in figure.

For the laminations to be aligned perfectly, two mandrels are used for each lamination for guiding purpose at the time of placement. These mandrels are mounted on an inner 'mandrel table' as shown in figure. Initially, the mandrels are at a lowermost position and move upwards as the height of stacked laminations rises. It is necessary to move the entire mandrel table upwards so that all the mandrels move up at the same time.

Two sets of mandrels are required, one set of 18 mandrels for 270MW laminations and other set of 18 mandrels for 150MW laminations.

After the laminations are assembled to a desired stack height, entire stack is lifted and transported by crane using the 'lifting pins'. Figure depicts a similar operation.

A. Specification of the Outer Assembly Table for 270MW/150MW Laminations:

SR. No.	DESCRIPTION	BHEL Specification	Vendor Specification/Remark
1	**Scope**	To design, manufacture and supply 1 (one) circular table that is common for 270MW and 150MW laminations.	
2	**Diameter**	OD: 2800 mm, ID: 1100 mm	
3	**Height**	900-1000 mm approx.	
4	**Mandrel height above table surface**	4 stacks x 55 layers x 0.65 mm thick = 143 mm, say 200mm	
5	**Number of holes**	There shall be 18 holes for mandrel travel for 270 MW lamination and 18 holes for mandrel travel of 150MW lamination. A step of dia=mandrel diameter + 30 mm and depth of 20mm may be required to accommodate lifting pin collar (depending on the design of the lifting pin). These holes should be offset on the circumference as only one set of 18 mandrels will be used at a time.	
6	**Material**	Mild Steel	
7	**Surface Finish**	Ra 6.3. The surface should be treated such that no rust formation takes place.	

		Means of preventing rust formation of the surface should be specified by vendor.	
8	**Supporting Weight**	Should support 4 stacks of 55 layers of laminations (each layer has 9 laminations) i.e. 4 x55 X 9 = 1980 laminations i.e. 1980 x 2.5 kg. = 4950 Kg. Say 6000 Kg.	

B. Specification of the Inner Mandrel Table for 270MW/150MW Laminations:

SR. No.	DESCRIPTION	BHEL Specification	Vendor Specification/Remark
1	**Scope**	To design, manufacture and supply 1 (one) mandrel table that is common for 270MW and 150MW laminations including 18 mandrels for 270MW laminations and 18 mandrels for 150MW laminations (total 36 mandrels).	
2	**Number of mandrels**	a. There should be provision to mount 36 mandrels. One set of 18 mandrels shall be mounted for 270MW laminations and another set of 18 mandrels shall be mounted for 150MW laminations. b. Only one set of mandrels shall be used at a time. c. The mandrels shall be offset i.e. mandrels for 270MW laminations and mandrels for 150MW laminations shall be offset on circumference by a distance such that the holes for two variants do not overlap.	
3	**Diameter**	Depending on the outer assembly table	
4	**Height**	To suit the mandrels and the outer table.	
5	**Material**	a. For table – MS b. For Mandrel – As specified in drawing	
6	**Surface Finish**	a. For table - Vendor to specify b. For mandrel – High grade stainless	

		steel finish	
7	**Supporting Weight**	Should be able to support 18 mandrels at a time. Consideration should be given to any resistance the mandrels will encounter while traveling up or down.	
8	**Speed of travel**	The mandrels should be able to travel at least 90 mm/min in automatic and manual modes.	
9	**Mechanism of mandrel actuation**	To be specified by vendor	
10	**Duty Cycle of mandrel actuation**	100% Continuous	
11	**Controls**	Automatic control triggered by robot or PLC output and manual controls through up and down push buttons.	
12	**Safety**	Mechanical dead limits and adjustable electrical non-contact type switch/sensors for up and down travel.	
13	**Position Feedback**	Position of mandrel should be known through encoder.	

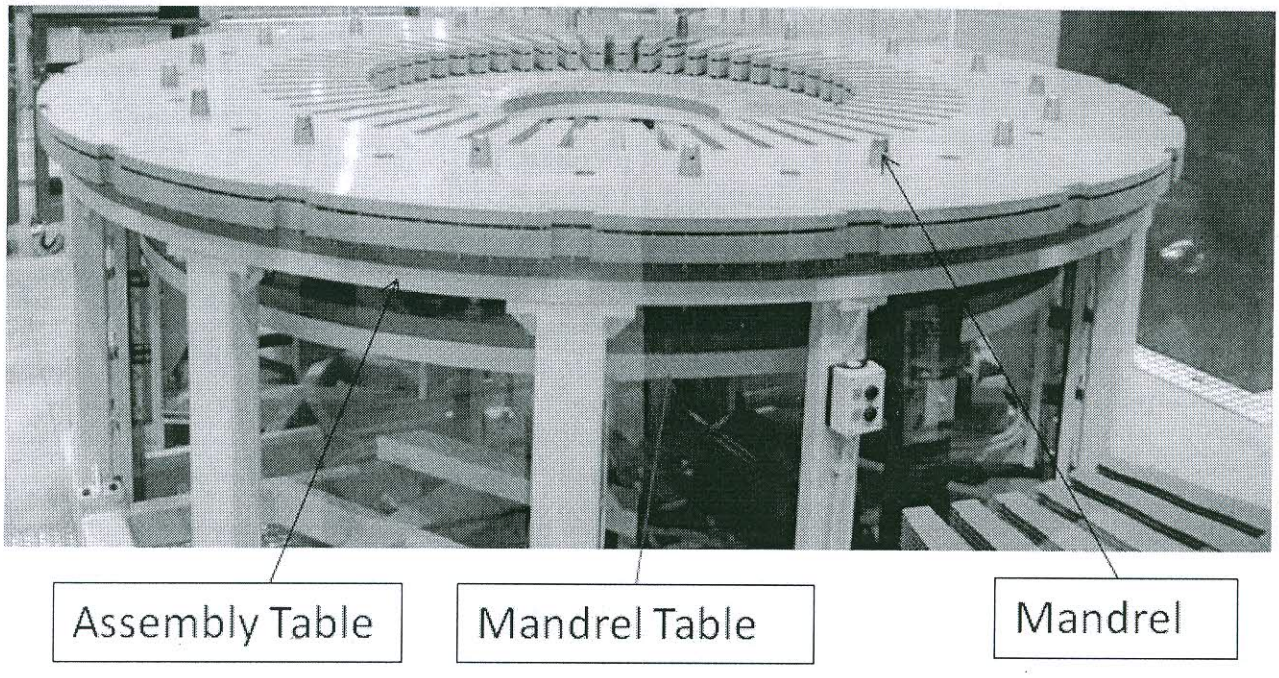

Figure 1

Robotic Assembly Process

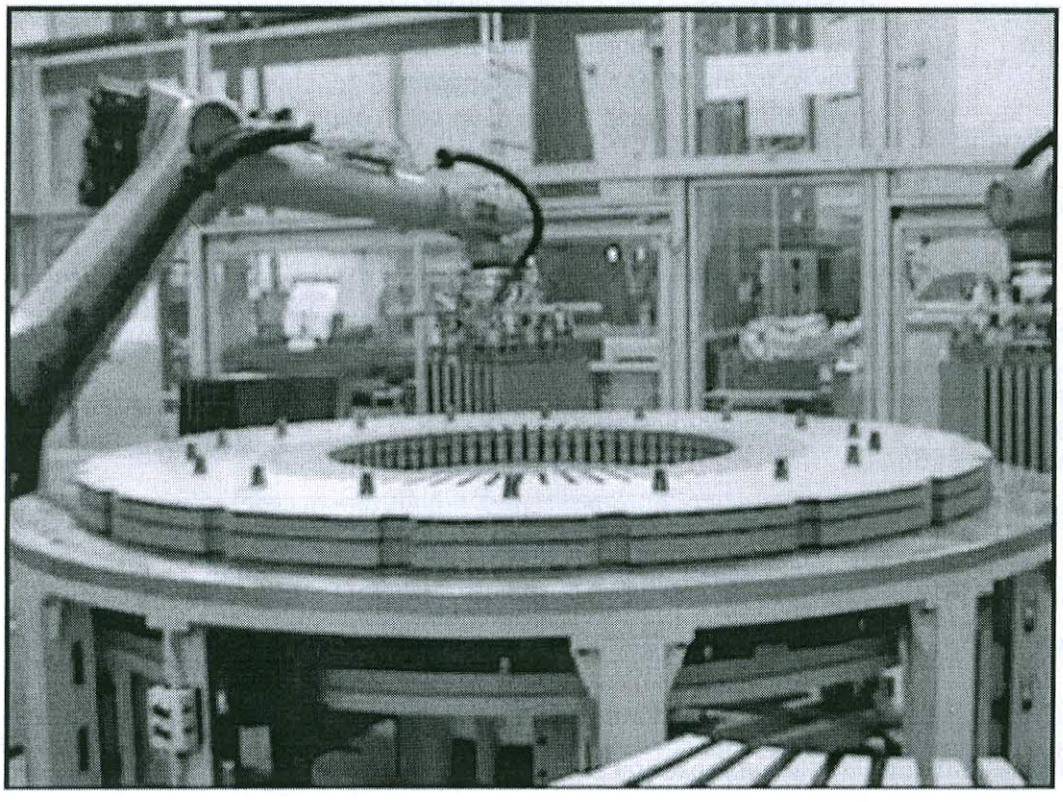

Figure 2