

1. Specification for Assembly Table with Motorized Mandrel Table for Laminations
FOR 660MW 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 large mandrels are used for each full lamination and one large and one small mandrel is used for each half 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.

As there are 10 full laminations and 1 half lamination in a layer, 21 large (20 for full laminations and 1 for half lamination) and 2 small mandrels (for half lamination only) are required.

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

A. Specification of the Outer Assembly Table for 660MW Laminations:

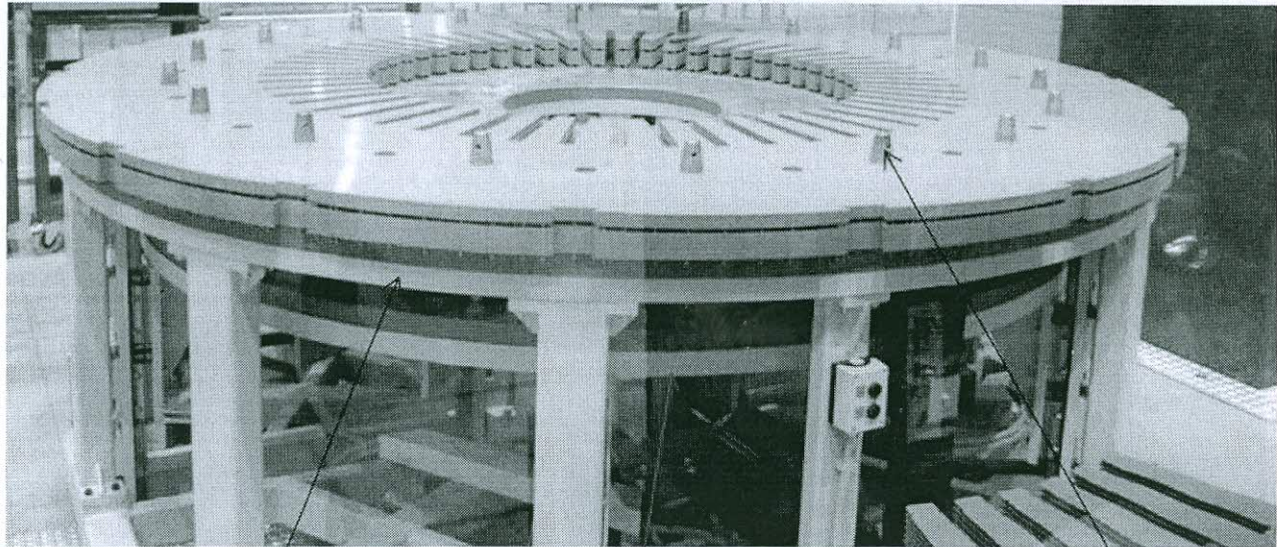
SR. No.	DESCRIPTION	BHEL Specification	Vendor Specification/Remark
1	Scope	To design, manufacture and supply 1 (one) circular table for 660MW laminations.	
2	Diameter	OD: 2800 mm, ID: 1100 mm	
3	Height	900-1000 mm approx.	
4	Mandrel height above table surface	4 stacks x 55 layers x 0.65 mm thick = 143 mm, say 200mm	
5	Number of holes	There shall be 21 large holes (two each for ten full laminations + one for half lamination) and two small holes (for half lamination) for mandrel travel for 660 MW 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).	
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 11 laminations) i.e. 4 x55 X 11 = 2420 laminations i.e. 2420 x 2.5 kg. = 6050 Kg. Say 6500 Kg.	

B. Specification of the Inner Mandrel Table for 660MW Laminations:

SR. No.	DESCRIPTION	BHEL Specification	Vendor Specification/Remark
1	Scope	To design, manufacture and supply 1 (one) mandrel table for 660MW including 21 large and 2 small mandrels.	
2	Number of mandrels	a. 21 large and 2 small mandrels shall be mounted. b. Large and small mandrels shall be offset.	
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 21 large and 2 small 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.	



Assembly Table

Mandrel Table

Mandrel

Figure 1

Robotic Assembly Process

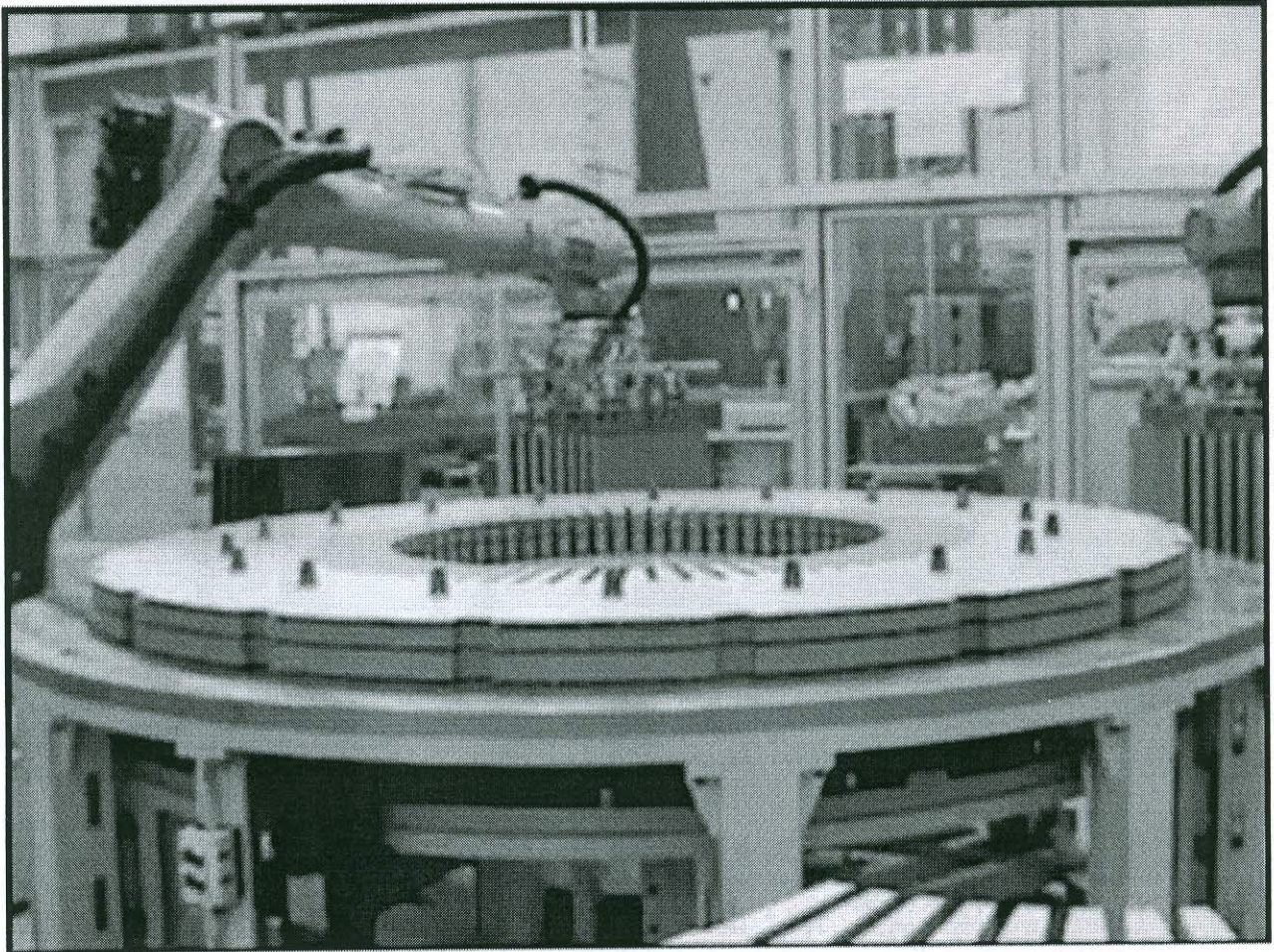


Figure 2

**2. Specification for Pallets and Pickup Table (De-stacking Table) with Motorized Mandrels
FOR 660MW LAMINATIONS**

Description:

Pallets and Pick-up tables are required for 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).

Initially, the laminations will be stacked on the pallet manually and two mandrels will be used for alignment of laminations. Once the desired numbers of laminations are stacked, the mandrels will be removed and the pallet will be transported to the pick-up table by crane.

The pallet is then put on the pick-up table. Two locating pins shall be used for locating of the pallet on the pick-up table. Two motorized mandrels mounted below the pick-up table shall then move up till the tapered part of the mandrel is in level with stack of laminations.

As the robot picks up laminations from pick-up table, and the stack height decreases, two mandrels used for alignment of laminations will gradually travel down.

A. Specification of the Pallet:

SR. No.	DESCRIPTION	BHEL Specification	Vendor Specification/Remark
1	Scope	To design, manufacture and supply 4 pallets for full laminations and 2 pallets for half laminations including 10 large mandrels (8 for full lamination pallets + 2 for half lamination pallet) and 2 small mandrels for half lamination pallets.	
2	Dimensions	To suit the laminations	
3	Material	a. For table – MS b. For Mandrel – As specified in drawing	
4	Surface Finish	a. For pallet - Vendor to specify. The surface should be treated such that no rust formation takes place. Means of preventing rusting formation of the surface should be specified by vendor. b. For mandrel – High grade stainless steel finish	
5	Mandrel positioning	One set of two large mandrels are required for each full lamination pallet. One set consisting of one large and one small mandrel is required for half	