भारत इलेक्ट्रॉनिक्स BHARAT ELECTRONICS	शीर्षक Doc. Title	Specifications for Industry 4.0 Pilot Project					पार्ट संख्या Part no.		CxxxxxxxxxX	
	विभाग Dept.	Fab-C	द्वारा तैयार Prepared by	Apoorv Nema Deputy Manager	द्वारा समीक्षित Reviewed by	Anupam Jha Deputy Manager	संस्करण Version	P1	पृष्ठ संख्या Pg. no.	1 of 04

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Sl. no.	**Parameter**	**Specification / Requirement**	**Detail Requirement**
1.	**Scope**	Implementation of Industry 4.0 pilot Project at Fabrication Components	a) Design & Development (Front End & Back end) of turnkey solutions to convert existing mechanical manufacturing process into digital format. b) Supplying and installations of IoT/OPC for the machines listed. i.) DMG DMU 60 eVo linear (Controller- Heidenhain iTNC 640) ii.) DMG DMU 60T mB (Controller - Heidenhain iTNC 530) iii.) DMG CTX BETA 1250TC4A (Controller -Siemens 840D SL)
2	**Machine Connectivity**	Capturing real time data and generation of report that can be stored **(in Server)** and retrievable **(Machine,date and shift wise)** for mentioned 3 machine to optimize process, ensuring quality, monitoring Inventory and minimizing downtime.	Capturing of **real time digitized data** for above said machines are mentioned below: **2.1 <u>Production Data:</u>** • Production Count: Number of Unit produced in per shift. • Rejection rates: Number of defective or rejected parts. • Yield Rates: Percentage of good parts produced relative to total output. • Production Rates: Rate of Production per shift. • Planned versus Actual production. **2.2 <u>Machine performance Data:</u>** • Operating parameter: Speed, feed. • Cycle time : Time taken for each operation and job. • Throughput: Quantity of output produced over a shift. • Utilization Rates: Percentage of time the machine is actively used versus idle time. **2.3 <u>Operational Efficiency Data</u>:** • Overall Equipment Effectiveness **(OEE) :** Combining availability, performance and quality to assess equipment efficiency machine as well as Plant wise. **2.4 <u>Machine Maintenance:</u>** • Downtime tracking: Reason for downtime events and duration. • MTTR & MTBF need to be calculated by system. • Details of daily/weekly/Monthly maintenance with check list. • Calibration data of machines with due date and report (with alert).

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3	**Shop Floor Planning**	During shop floor planning, data need to be **stored (in Server)**, **retrievable (based on machine, date, shift , part number, & production order)**, and has to be **dynamic.**	**3.1 <u>Capacity Planning:</u>** System should be capable of evaluating the **existing available capacity (Hrs)*** with **required capacity Hrs** ** • ***Existing available capacity Hrs** includes operation wise available time for manufacturing and inspection of parts. Operation includes Milling, Turning, Turn-Mill, Wire-cut, CMM & VMS. • Input for *existing available capacity will be keyed in terms of total available time (Hrs) for each operation. • ** **Required capacity Hrs** includes Cycle time to manufacture & inspect the parts based on production order, & forecasted. • Input for **required capacity Hrs will be keyed in terms of part number and operation wise cycle time (Hrs) for each job. **3.2 <u>Configuration Management:</u>** • System shall validate & give notification to Planning in-charge ensuring latest version of drawing and 3d model is being used to generate CAM/CMM/VMS Program, **MPP** & **IPID**. • Recording and reporting of change through out the manufacturing process need to stored. **3.3 <u>Shop Scheduling:</u>** • System shall schedule the job, machine wise (17 Machines) based on Production Planning. • Machine schedule has to be dynamic in nature and can re-schedule based on priority (decided or changed). • **PDC** need to flagged for each job. • Input will be keyed in term of Part number, Production order and machine wise total time required (Hrs.) to manufacture & inspect the parts. **3.4 <u>Digital OARC</u>** • Conventional OARC shall be converted into digital OARC into the system. • Digital OARC shall have provision to enter actual time taken to complete the operation, details of operator, accepted job and remarks. **3.5 <u>Traceability</u>** • System should be capable of generating **travel card^** consisting of data matrix which contains RM details, RM part number, Heat No,, Production order number, BEL Part number & batch size. • **^Travel card** printed by the system should interlinked with the following **documents ($)** : 1) Part Drawing and 3d step file. 2) Manufacturing process Plan (MPP) which includes Pictorial job setups for each operation. 3) Tool list, CNC Pgm list, Jigs & fixture list for particular job. 4) In-process Inspection document (IPID) which includes dimensions need to checked after each operation with which instrument. **3.6 <u>Quality</u>** • Provision to upload data related to final Inspection plan need to be uploaded like 1) Ballooned drawing, CMM & VMS Pgm along with version control.

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4	**Production**	During actual production , System shall generate data and **stored (in Server)**, **retrievable (based on machine, date, shift , part number, production order, & operator)**, and has to be **verified** by Shop floor in-charge using his/her login I'd.	**4.1 <u>Display of Documents :</u>** • Upon scanning the **travel card^** using data matrix using bar code reader available at work spot by the operator **document ($)** interlinked should be displayed at the system. **4.2 <u>Digital Check/ Alert/ Pokayoke</u> :** a) System should validate & give notification for approval to Shop floor in-charge for the following setting done by operator as per Manufacturing Process Plan **(MPP)** before actual execution of CNC Program: • 2D -Drawing & 3D model as per latest version. • CNC Program selected. • Tools loaded. • Jigs & Fixture. • Job Setup in machine. • In-process inspection document (IPP) for particular stage. b) Machine **shall not start** until unless the sent notification is approved by Shop floor in-charge. **4.3. <u>In process Quality Control Data</u>:** • Dimensional measurement: Input of data from measuring instruments to In-process inspection document (IPID) along with instrument Calibration data. • Process control Monitoring: Deviation from quality control limit should be notified. **4.4. <u>Supply Chain and Inventory Data:</u>** • Tool usage : Number of Tools consumed per job/batch to be entered in the system with report generation facility. Provided solution should be capable of generating the complete report based on operator, machine part number and production order for reverse traceability.
5	**Quality Management**	During Final inspection , data need to be **stored (in Server)**, **non editable** and **retrievable (Machine, date, shift , part number, & production order)**.	**<u>Quality Inspection</u>** Provision in system to directly capture the final inspection report from CMM (2 No.) and VMS (1 No) along with generation of below documents. • FTP & Yield. • Corrective action and preventive action. • Non Conformity report. • Rework (If any) traceability. • Process capability of machine.
6	**Inventory**	In Inventory management, System shall trace the listed items. • Tools, jigs & fixture. • Machines spares & consumables (Oil,collets & holders). • Guages (with calibration alerts).	**<u>Inventory Management</u>** System should capable of tracing the below listed inventory items and can generate the data based on machine, date, shift , part number, production order & operator :

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7	**Standard Documentation**	**<u>Document Management</u>** System should capable of Storing the below listed documents in .xlsx & pdf format which can be editable and restored in the system. • AS & ISO Documents. • OSHAS, EMS & 5s Documents. • Machine Manuals. • Tools/OEM catalogues.
8	**Dashboard**	Design & Development of Dynamic dashboard(shown below) to display Plant & Machine level data. (Process Planning, Production, Quality, Maintenance, Inventory & Documentation).
9	**Support**	Minimum 2 year of support from installation & commissioning is to be provided at no extra cost.
10	**Training**	Minimum 6 man days of training to be provided in BEL premises at no extra cost.
11	**Login**	System shall comes with data security based on admin and user I'd. Admin login – 8 Nos. User login - 17 Nos.