**Process Control Document (PCD) for**

**Mill forms/feed stock**

**Document No: <Document No>**

**Issue/Rev No: <Issue No>**

**Date: <Date of Issue>**

Template No.

CEMILAC\_FFGP\_PCD\_08

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| <DESIGN  AGENCY  LOGO> | | **Document No.** |  | | | |
| **Issue No./**  **Rev No. :** | <00X>/ | **Issue Date :** | | <DD/MM/YYYY> |
| **Copy No. :** | 01 of N | **No. of**  **Pages :** | | < total no .of pages > |
| **Document Classification :** | 🞎 Secret 🞎 Confidential  🞎 Restricted 🞎 Unrestricted | | | |
| **Title:** | | | | | **Project/System :** | |
| **Process Control Document (PCD) for**  **Mill forms/feed stock** | | | | | < Project/System Name> | |
| **LRU/System Part No.** | |
| <No.> | |
| **Critical Level** | |
| <A/B/C/D/E> | |
|  | **Name & Designation** | | | | **Signature** | |
| Prepared By | <Design Rep Name>, < Designation> <Agency Name> | | | |  | |
| Reviewed By | <Project Leader Name>, <Designation> <Agency Name>  <AWG/QA HOD Name>, <Designation> <Agency Name> | | | |  | |
| Approved By | <Project Leader Name>, <Designation>  <Design Agency>  <Officer\_Name>, <Designation>  RCMA <Name> | | | |  | |
| **<Design Firm Name & Address>** | | | | | | |

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| **Manufacturing Plant** |  |
| **Company Name** |  |
| **Material Specification** |  |
| **Alloy Grade** |  |
| **Alloy Type** |  |
| **Supply condition** |  |
| **Heat Treatment Condition** |  |
| **Size range** |  |
| **Application** | Military Aircraft and Aero Engine Applications |

**Contents:**

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**Note / Disclaimer:**

1. **This Process Control Document template is applicable for materials like Mill forms/feed stock**
2. **If any details under the above headings/contents is IPR of the company, then an Internal control document shall be prepared and authenticated for those details by the company and the Internal document reference shall be mentioned in this Process control document (PCD).**
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**1.0 SCOPE**

This process documents covers process/manufacturing details for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**2.0 PROCESS ROUTE**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **PROCESS** | | | | **PROCESS / EQUIPMENT DETAILS** | | |
| **LIGHT ALLOYS (AL/MG ALLOYS)** | | | | | | | |
| **1.1** | **MELTING AND CASTING DETAILS** | | | | 1. Make: 2. Capacity: 3. Refractory Used: 4. Melting: 5. Melting Rate: 6. Charging by: 7. Charging Machine 8. Typical Charge: | | |
| **PROCESS SUMMARY:** | | | | | | |
| **1.2** | **ROTARY GAS INJECTOR (RGI)** | | | | 1. Degassing: 2. Make: | | |
| **PROCESS SUMMARY:** | | | | | | |
| **1.3** | **SPECTRO ANALYSIS (CHEMICAL ANALYSIS)** | | | | 1. Make: 2. Calibration Frequency: 3. Std. Used: | | |
| **PROCESS SUMMARY:** | | | | | | |
| **1.4** | **ALPUR DEGASSER** | | | | 1. Make: 2. Degassing: | | |
| **PROCESS SUMMARY:** | | | | | | |
| **1.5** | **GRAIN REFINEMENT** | | | | 1. Make: 2. Grain Refinement: | | |
| **PROCESS SUMMARY:** | | | | | | |
| **1.6** | **METAL FILTRATION** | | | | 1. Make: 2. Filter: | | |
| **PROCESS SUMMARY:** | | | | | | |
| **1.7** | **HYDROGEN ANALYSIS** | | | | | | |
| **PROCESS SUMMARY:** | | | | | | |
| **1.8** | **DIRECT CHILL CASTING** | | | | Make: | | |
| **PROCESS SUMMARY:** | | | | | | |
| **1.9** | **HOMOGENISING OF LOGS** | | | | 1. Make: 2. Capacity: 3. Max Working Temp.: 4. Heating Chamber: 5. Soaking Temp. 6. Homogenisation 7. Schedule Cooling Facility: | | |
| **PROCESS SUMMARY:** | | | | | | |
| **1.10** | **CUTTING OF LOGS** | | | | Make: | | |
|  | **PROCESS SUMMARY:** | | | | | | |
| **1.11** | **TURNING AND CHAMFERING OF PARTED LOGS** | | | | 1. Make: 2. Size: | | |
|  | **PROCESS SUMMARY:** | | | | | | |
| **1.12** | **STAMPING OF BILLETS (PUNCH & HAMMER)** | | | | | | |
|  | **PROCESS SUMMARY:** | | | | | | |
| **1.13** | **ULTRASONIC TESTING** | | | | | | |
|  | **PROCESS SUMMARY:** | | | | | | |
| **1.14** | **SECONDARY PROCESSING (EXTRUSION / ROLLING / FORGING) OF BILLETS** | | | | 1. Make: 2. Capacity: 3. Parameters: | | |
|  | **PROCESS SUMMARY:** | | | | | | |
| **1.15** | **Heat Treatment (Solutionising/Aging)** | | | | 1. Make:  2. Capacity: | | |
|  | **PROCESS SUMMARY:** | | | | | | |
| **1.16** | **STRETCHING** | | | 1. Make:  2. Capacity: | | | |
|  | **PROCESS SUMMARY:** | | | | | | |
|  | | | | | | | |
| **FERROUS/NICKEL ALLOYS** | | | | | | | |
| **2.1** | **AIR INDUCTION MELTING (AIM)** | 1. Make: 2. Model: 3. Capacity: | | | | | |
| **PROCESS SUMMARY:** | | | | | | |
| **2.2** | **ELECTRIC ARC FURNACE (EAF)** | | | | 1. Make: 2. Capacity: 3. Refractory consumption: 4. Water cooled panels: 5. Oxygen Lance: 6. Post combustion: 7. De-dusting system: 8. Flow rate oxygen: 9. Slag forming addition:   Dolo lime:  Lime:   1. Charge mix up details: Hot Metal(HM): 2. Direct Reduced Iron (DRI): 3. Scrap (Returns): 4. Arc length: 5. Arc current: | | |
| **PROCESS SUMMARY:** | | | | | | |
| **2.3** | **ARGON OXYGEN DECARBURIZATION (AOD)** | | 1. Make: 2. Capacity: 3. No of Tuyeres: 4. Bottom flow: 5. Top Lance: 6. Process Gas type: 7. Arrangement of side wall nozzles: | | | | |
|  | **PROCESS SUMMARY:** | | | | | | |
| **2.4** | **LADLE HEATING FURNACE**  **(LHF)** | | | | 1. Make: 2. Capacity: 3. Ladle diameter: 4. Electrode Diameter: 5. Electrode length: | | |
|  | **PROCESS SUMMARY:** | | | | | | |
| **2.5** | **VACUUM DEGASSING (VD)** | | | | 1. Make:  2. Capacity:  3. Automatic Wire feeding system  4. Automatic Ejector operating system  5. Vacuum level: | | |
| **PROCESS SUMMARY:**   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Chemical Composition (wt. %) |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  | | | | | | | |
| **2.6** | **ELECTRO SLAG RE-MELTING (ESR)** | | | | 1. Make: 2. Ingot Dia Size: 3. Capacity: 4. Max. Ingot weight: 5. Vacuum Hood: 6. Slag feeder: 7. Furnace Head: 8. Protective gas: 9. Fully Co-Axial Design: | | |
| **PROCESS SUMMARY:** | | | | | | |
|  | **VACUUM ARC**  **RE-MELTING**  **(VAR)** | | | | | | 1. Make:  2. Ingot Día Size:  3. Max Capacity:  4. Max. Crucible Día:  4. Cooling Type  5. Furnace Head:  6. Ultimate Vacuum:  7. Fully PLC Automatic Melting: |
| **PROCESS SUMMARY:** | | | | | | |
| **2.7** | **REHEATING**  **(If applicable)** | | | | | 1. Make  2. Reheating of Furnace:  3. Calibration of Furnace: | |
|  | | | | | | |
| **2.8** | **SECONDARY PROCESSING (EXTRUSION / ROLLING / FORGING) OF BILLETS** | | | | 1. Make:  2. Capacity of press:  3. Re-Heating Furnace:  4. Calibration of Furnace: | | |
| **PROCESS SUMMARY:** | | | | | | |
| **2.9** | **HEAT TREATMENT** | | | | 1. Make:  2. Type of Furnace:  3. Type of Furnace Heating:  4. Calibration of Furnace: | | |
| **PROCESS SUMMARY:**   |  |  |  |  | | --- | --- | --- | --- | | **Heat Treatment** | **Heat Treatment cycle** | | | | **Temp (ºC)** | **Min soaking time** | **Cooling media** | |  |  |  |  | |  |  |  |  | | | | | | | |
| **2.9** | **PEELING/ MACHINING** | | | | 1. **Peeling M/c input size:** 2. **Polishing M/c input size:**   **3. Machining (turning) input size:**  **4. Coil to bar peeling:**  **5. Wire draw unit:** | | |
|  | | | | | | |

* 1. **STAMPING**

**4.0 PROCESS COMPLIANCE CHECK POINTS**

|  |  |  |
| --- | --- | --- |
| **PROCESS PARAMETERS** | **ACCEPTANCE CRITERIA** | **COMPLIANCE (YES/NO)** |
| For ex: Super heat temperature | 500-540 deg C |  |
| Flow rate |  |  |
| Melting rate |  |  |

**5.0 FINAL INSPECTION**

**6.0 DOCUMENTATION**

**7.0 DISPATCH**

**8.0 PROCESS FLOW CHART**

**9.0 BILL OF MATERIAL**

|  |  |  |
| --- | --- | --- |
| **RAW MATERIAL** | **SPECIFICATION** | **VENDOR** |
|  |  |  |
|  |  |  |

* **THIS DOCUMENT IS A GUIDANCE DOCUMENT. APPLICABLE SECTION/ TABLE ROWS MAY BE CONSIDERED. ANY ADDITIONAL DETAILS MAY BE ADDED. ANY NOT APPLICABLE SECTION/ TABLE ROWS MAY BE DELETED. THE TEMPLATE IS VERY GENERAL AND VARY WITH MATERIAL CLASS TO CLASS AND/OR GRADE TO GRADE, PROCESS TO PROCESS, DEVELOPMENT AGENCY PROCESS PLANT AND EQUIPMENTS. THE PROCESS CONTROL DOCUMENT MAY BE FINETUNED WITH THE TAA BEFORE LTCC BASED ON MATERIAL, APPLICATION AND EQUIPMENTS.**