**Process Control Document (PCD) for**

**Additive Manufacturing**

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**Note / Disclaimer:**

1. **This Process Control Document template is applicable for Additive manufacturing components**
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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# **SCOPE**

This document provides process details to be followed during the manufacturing of ................................... through the .................. process.

# **REFERENCE DOCUMENTS**

Below are the reference documents to be followed along with this document.

|  |  |  |
| --- | --- | --- |
| Sl. No | Document Title | Document Reference No.: |
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# **MANUFACTURING PROCESS FLOW**

# **RAW MATERIAL**

The metal powder shall meet the chemical composition requirements as shown in Table 1 as per ASTM ..............

Table 1: chemical composition requirements

|  |  |
| --- | --- |
| Element | Limits (weight%) |
|  |  |
|  |  |
|  |  |

Powder sampling is to be done as per ASTM B215. Qualification tests & acceptance criteria are to be followed as per the test schedule for metal powder for use in the ..................... process.

# **MANUFACTURING OF .................... THROUGH .................. PROCESS**

## **File Preparation**

All the machining stock and support structure type details shall be recorded in Ref no......... AM machine parameters shall be recorded in Ref no......... Fine quality STL should be used for file preparation.

## **....................... Process**

## **Build Plan / Layout**

The test specimens/samples shall be built along with the component- ...................... in the same build as per Figure 2. Coupons will be identified using the orientation and coupon numbers.

Part figure

Figure 2: Build layout of ................. component along with test samples

## **Machine & Process Parameters**

Table 2 shows the details of the process parameters followed during the manufacturing of the ........... through the ........ process.

Table 2: Powder bed fusion machine technical data

|  |  |
| --- | --- |
| **Description**  | **Parameter** |
| Machine |  |
| Laser type & Power |  |
| Powder Size |  |
| Focus diameter |  |
| Layer thickness |  |
| Hatch Speed (µm) |  |
| Scan speed |  |
| Depth of penetration (µm) |  |
| Laser scan pattern |  |
| Pre heating platform/material type/thickness |  |
| Baseplate Material |  |
| Baseplate Temperature |  |
| Re-coater Type |  |
| Inert gas Type |  |
| Location of support structures |  |
| Surface roughness of component |  |

\*

## **Powder Handling & Build wise plan**

Powder handling and blending procedure will be followed as mentioned below.

* Post completion of every build the powder will be unloaded by dedicated Integrated Process Chain Management (IPCM).
* All used powder will be sieved with a dedicated sieving module with a mesh size of ------------ µm (ASTM Mesh No. ) to remove agglomerates from the powder.
* Top-up will be done by **virgin/reuse** powder for consumed powder quantity and a record will be maintained for added quantity. The virgin and reuse powder will be mixed manually with the proper instrument.
* Before blending or mixing with **virgin/reuse** powder, ------------ grams of reused powder will be collected and tests will be performed as mentioned in Table 2 of the Test Schedule. The reuse powder will be blended if all properties are meeting the requirements as per Table 2 of the Test Schedule.
1. Record of reuse and mixing quantity shall be maintained. Powder storage shall be as per Ref no.........
2. **STRESS RELIEVING**

Stress relieve at ------------ and soak for ------------ minutes ------------ and the air cooling or slower to ambient temperature.

# **WIRE CUT**

Parts and Coupon shall be separated from baseplate using inhouse EDM- wire cut machine as per work instruction Ref no.........

# **SUPPORT REMOVAL**

All the soft support indicated in Ref no........ shall be removed manually. Care should be taken during support removal so that parts shouldn’t damage during support removal.

# **HEAT TREATMENT ()**

**Solution Treatment:** Heat to a minimum of ------------ and soak for ------------ minutes, followed by quenching in water/equivalent.

**Aging**: Heat to ------------ for ------------ minutes followed by air cool/equivalent.

# **SHOT PEENING**

Shot peening shall be performed after HT as per work instruction Ref no.........

# **MACHINING**

Machining and detailing to machined drawing will be carried out in the Wipro group facility and if required to outsource. Process to be done as per stage drawings, machining process plan & Ref no........

# **INSPECTION**

Inspection and testing shall be as per the latest revision of test schedule. Also various stages of witness / perform / review requirement is listed in the test schedule.

**PROCESS COMPLIANCE CHECK POINTS**

|  |  |  |
| --- | --- | --- |
| **PROCESS PARAMETERS** | **ACCEPTANCE CRITERIA** | **COMPLIANCE (YES/NO)** |
| For ex: LASER POWER | 200-250W | 220W, Complied |
| SCANNING SPEED | 200-300 mm/s | 220 mm/s |
| Powder size |  |  |

# **PART MARKING & PACKING**

* The part shall be marked in accordance with Ref no........ and the stage drawing.
* The part shall be packed in such a way to prevent any damage or corrosion from occurring while handling, transportation, and storage. Each individual package of the part shall be provided with the outside marking ensuring traceability.

# **Traceability**

# **Bill of materials**

* **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.**