



# Cladding-Technology-Shanxi-Co.,-Ltd- CLADDING-MPS-004-Cladding-Reducer- MPS

科雷丁技术（山西）有限公司

Cladding-Technology-Shanxi-Co.,-Ltd

主生产计划

Master Production Schedule

| 文件编号 | Document No.   | CLADDING-MPS-004                |
|------|----------------|---------------------------------|
| 版本号  | Version        | A/0                             |
| 生效日期 | Effective Date | 2025-01-01                      |
| 编制部门 | Prepared By    | 生产计划部 Production Planning Dept. |
| 审核   | Reviewed By    | 生产副总 VP of Production           |
| 批准   | Approved By    | 总经理 General Manager             |



## 1 目的 Purpose

1.1 建立堆焊异径管同心/偏心成形及堆焊层质量控制的主生产计划管理体系，确保生产计划与市场需求、产能配置、工艺要求相匹配。

1.2 Establish a master production schedule management for concentric/eccentric forming of clad reducers and cladding layer quality control, ensuring production plans align with market demand, capacity allocation, and process requirements.

## 2 适用范围 Scope

2.1 本计划适用于公司法兰堆焊、管件堆焊、钢管堆焊、轴套管堆焊、模具堆焊修复及增材制造产品的主生产计划编制与执行。

2.2 This schedule applies to the master production planning and execution for flange cladding, pipe fitting cladding, steel pipe cladding, shaft sleeve cladding, mold cladding repair, and additive manufacturing products.

## 3 职责 Responsibilities

| 部门/岗位 | Department/Position       | 职责             | Responsibilities                                 |
|-------|---------------------------|----------------|--------------------------------------------------|
| 生产计划部 | Production Planning Dept. | 编制主生产计划，协调资源分配 | Prepare MPS, coordinate resource allocation      |
| 生产部   | Production Dept.          | 执行生产计划，反馈进度    | Execute production plan, report progress         |
| 工艺部   | Process Engineering Dept. | 提供工艺参数与技术支持    | Provide process parameters and technical support |
| 质量部   | Quality Dept.             | 制定检验标准，监督质     | Establish inspection                             |



|     |                 |             |                                               |
|-----|-----------------|-------------|-----------------------------------------------|
|     |                 | 量           | standards, supervise quality                  |
| 设备部 | Equipment Dept. | 保障设备运行状态    | Ensure equipment operational status           |
| 销售部 | Sales Dept.     | 提供订单信息与需求预测 | Provide order information and demand forecast |

## 4 管理内容与程序 Management Content and Procedures

### 4.1 生产计划编制 Production Planning

#### 4.1.1 订单信息收集 Order Information Collection

销售部负责收集客户订单信息，包括产品规格、数量、交期要求，并录入 ERP 系统。对于堆焊异径管产品，需明确以下技术参数：

- 异径管规格：DN50-DN1200
- 堆焊层数：1-6 层
- 堆焊材料：Cr-Ni 合金、Co 基合金、Ni 基合金
- 成形方式：同心成形/偏心成形
- 表面粗糙度要求：Ra3.2-Ra12.5

The Sales Department is responsible for collecting customer order information, including product specifications, quantities, delivery requirements, and entering them into the ERP . For cladded reducer products, the following technical parameters must be clarified:

- Reducer specifications: DN50-DN1200
- Cladding layers: 1-6 layers
- Cladding materials: Cr-Ni alloy, Co-based alloy, Ni-based alloy
- Forming methods: Concentric/Eccentric forming
- Surface roughness requirements: Ra3.2-Ra12.5

#### 4.1.2 产能评估 Capacity Assessment

生产计划部根据订单信息，结合以下因素进行产能评估：

| 评估项目 | Assessment Item | 评估标准 | Assessment Criteria |
|------|-----------------|------|---------------------|
|------|-----------------|------|---------------------|



|          |                        |              |                                     |
|----------|------------------------|--------------|-------------------------------------|
| TIG 堆焊产能 | TIG Cladding Capacity  | 60-80 kg/h   | 60-80 kg/h                          |
| MIG 堆焊产能 | MIG Cladding Capacity  | 150-250 kg/h | 150-250 kg/h                        |
| 设备可用率    | Equipment Availability | ≥85%         | ≥85%                                |
| 人员配置     | Personnel Allocation   | 按工艺要求配置      | Configured per process requirements |
| 材料供应     | Material Supply        | 库存满足 7 天生产   | Inventory meets 7-day production    |

#### 4.1.3 计划排产 Scheduling

生产计划部依据订单优先级、交期要求、产能状况编制主生产计划，计划周期为月度滚动计划，每周更新。

排产原则：

- 优先安排交期紧急订单
- 合理搭配 TIG/MIG 工艺设备
- 集中安排同规格产品减少换型
- 预留 10%产能应对紧急插单

The Production Planning Department prepares the master production schedule based on order priority, delivery requirements, and capacity status. The planning cycle is a monthly rolling plan, updated weekly.

Scheduling principles:

- Prioritize urgent delivery orders
- Reasonably allocate TIG/MIG process equipment
- Batch same-specification products to reduce changeovers
- Reserve 10% capacity for emergency insertions

## 4.2 堆焊异径管同心/偏心成形工艺控制 Process Control for Concentric/Eccentric Forming

### 4.2.1 同心成形工艺 Concentric Forming Process

同心成形适用于对堆焊层厚度均匀性要求较高的产品，工艺控制要点如下：

| 控制项目 | Control Item       | 控制要求    | Control Requirements |
|------|--------------------|---------|----------------------|
| 工件装夹 | Workpiece Clamping | 中心定位，偏差 | Center positioning,  |



|       |                         |                     |                               |
|-------|-------------------------|---------------------|-------------------------------|
|       |                         | $\leq 0.5\text{mm}$ | deviation $\leq 0.5\text{mm}$ |
| 焊接参数  | Welding Parameters      | 按工艺卡执行              | Execute per process card      |
| 层间温度  | Interpass Temperature   | 150-250°C           | 150-250°C                     |
| 稀释率控制 | Dilution Rate Control   | $\leq 15\%$         | $\leq 15\%$                   |
| 层厚控制  | Layer Thickness Control | $\pm 0.2\text{mm}$  | $\pm 0.2\text{mm}$            |

同心成形工艺参数（TIG 堆焊）：

| 参数    | Parameter          | 数值范围          | Value Range   |
|-------|--------------------|---------------|---------------|
| 焊接电流  | Welding Current    | 120-180A      | 120-180A      |
| 电弧电压  | Arc Voltage        | 12-16V        | 12-16V        |
| 焊接速度  | Welding Speed      | 80-150mm/min  | 80-150mm/min  |
| 送丝速度  | Wire Feeding Speed | 300-500mm/min | 300-500mm/min |
| 保护气流量 | Shielding Gas Flow | 12-18L/min    | 12-18L/min    |

#### 4.2.2 偏心成形工艺 Eccentric Forming Process

偏心成形适用于需要局部强化或特定部位加厚处理的异径管产品，工艺控制要点如下：

| 控制项目  | Control Item              | 控制要求   | Control Requirements       |
|-------|---------------------------|--------|----------------------------|
| 偏心量设定 | Eccentricity Setting      | 按图纸要求  | Per drawing requirements   |
| 分区堆焊  | Zoned Cladding            | 分区编号管理 | Zoned numbering management |
| 过渡区处理 | Transition Zone Treatment | 平滑过渡   | Smooth transition          |
| 厚度检测  | Thickness Inspection      | 每区检测   | Inspect each zone          |

偏心成形工艺参数（MIG 堆焊）：

| 参数   | Parameter       | 数值范围     | Value Range |
|------|-----------------|----------|-------------|
| 焊接电流 | Welding Current | 200-350A | 200-350A    |



|       |                    |               |               |
|-------|--------------------|---------------|---------------|
| 电弧电压  | Arc Voltage        | 22-28V        | 22-28V        |
| 焊接速度  | Welding Speed      | 200-400mm/min | 200-400mm/min |
| 送丝速度  | Wire Feeding Speed | 500-800mm/min | 500-800mm/min |
| 保护气流量 | Shielding Gas Flow | 15-25L/min    | 15-25L/min    |

## 4.3 堆焊层质量控制 Cladding Layer Quality Control

### 4.3.1 原材料控制 Raw Material Control

| 材料类型 | Material Type | 控制要求              | Control Requirements                  |
|------|---------------|-------------------|---------------------------------------|
| 堆焊焊丝 | Cladding Wire | 化学成分符合 GB/T 14957 | Chemical composition meets GB/T 14957 |
| 母材   | Base Material | 材质证明齐全            | Material certificate complete         |
| 保护气体 | Shielding Gas | 纯度 $\geq 99.99\%$ | Purity $\geq 99.99\%$                 |

### 4.3.2 过程质量控制 In-Process Quality Control

堆焊过程质量控制检查点：

| 检查项目 | Inspection Item       | 检查频次  | Frequency      | 合格标准        | Acceptance Criteria             |
|------|-----------------------|-------|----------------|-------------|---------------------------------|
| 焊缝外观 | Weld Appearance       | 每层    | Each layer     | 无裂纹、气孔、夹渣   | No cracks, porosity, inclusions |
| 层间清理 | Interpass Cleaning    | 每层    | Each layer     | 清理干净        | Cleaned thoroughly              |
| 层间温度 | Interpass Temperature | 每层    | Each layer     | 符合工艺要求      | Meets process requirements      |
| 稀释率  | Dilution Rate         | 每 3 层 | Every 3 layers | $\leq 15\%$ | $\leq 15\%$                     |
| 几何尺寸 | Geometric Dimensions  | 每层    | Each layer     | 符合图纸要求      | Meets drawing requirements      |



### 4.3.3 成品检验 Finished Product Inspection

| 检验项目 | Inspection Item          | 检验方法     | Inspection Method         | 合格标准          | Acceptance Criteria          |
|------|--------------------------|----------|---------------------------|---------------|------------------------------|
| 外观检查 | Visual Inspection        | 目视+放大镜   | Visual + Magnifier        | 表面平整，无缺陷      | Smooth surface, no defects   |
| 尺寸检查 | Dimensional Inspection   | 三坐标测量    | CMM                       | 符合图纸公差        | Meets drawing tolerances     |
| 硬度测试 | Hardness Test            | HB/HRC   | HB/HRC                    | 符合技术要求        | Meets technical requirements |
| 无损检测 | NDT                      | UT/MT/PT | UT/MT/PT                  | 符合 NB/T 47013 | Meets NB/T 47013             |
| 化学成分 | Chemical Composition     | 光谱分析     | Spectral Analysis         | 符合标准要求        | Meets standard requirements  |
| 金相组织 | Metallographic Structure | 金相显微镜    | Metallographic Microscope | 组织均匀          | Uniform structure            |

## 4.4 生产进度跟踪 Production Progress Tracking

### 4.4.1 进度报告 Progress Reporting

生产部每日向生产计划部报告生产进度，包括：

- 当日完成数量
- 累计完成数量
- 计划完成率
- 异常情况说明

The Production Department reports production progress to the Production Planning Department daily, including:

- Daily completed quantity
- Cumulative completed quantity
- Plan rate
- Abnormal situation description

### 4.4.2 异常处理 Abnormal Handling

当生产进度滞后超过 5%时，启动异常处理程序：



1. 生产计划部分析原因
2. 制定赶工方案
3. 协调资源支持
4. 跟踪落实效果

When production progress lags by more than 5%, initiate the abnormal handling procedure:

5. Production Planning Department analyzes the cause
6. Develops a catch-up plan
7. Coordinates resource support
8. Tracks implementation effectiveness

## 5 监督考核 Supervision and Assessment

### 5.1 计划准确率考核 Plan Accuracy Assessment

| 考核指标  | Assessment Indicator      | 目标值  | Target Value | 考核周期 | Assessment Cycle |
|-------|---------------------------|------|--------------|------|------------------|
| 计划完成率 | Plan Rate                 | ≥95% | ≥95%         | 月度   | Monthly          |
| 交期达成率 | Delivery Achievement Rate | ≥98% | ≥98%         | 月度   | Monthly          |
| 计划调整率 | Plan Adjustment Rate      | ≤10% | ≤10%         | 月度   | Monthly          |

### 5.2 质量控制考核 Quality Control Assessment

| 考核指标  | Assessment Indicator    | 目标值  | Target Value | 考核周期 | Assessment Cycle |
|-------|-------------------------|------|--------------|------|------------------|
| 一次合格率 | First Pass Rate         | ≥95% | ≥95%         | 月度   | Monthly          |
| 客户投诉率 | Customer Complaint Rate | ≤1%  | ≤1%          | 季度   | Quarterly        |
| 返工率   | Rework Rate             | ≤3%  | ≤3%          | 月度   | Monthly          |



## 6 附则 Supplementary Provisions

6.1 本计划由生产计划部负责解释和修订。

6.2 This schedule is interpreted and revised by the Production Planning Department.

6.3 本计划自发布之日起执行，原有相关计划同时废止。

6.4 This schedule takes effect upon release, and previous related schedules are simultaneously abolished.

编制 Prepared By: \_\_\_\_\_ 日期 Date: \_\_\_\_\_

审核 Reviewed By: \_\_\_\_\_ 日期 Date: \_\_\_\_\_

批准 Approved By: \_\_\_\_\_ 日期 Date: \_\_\_\_\_

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