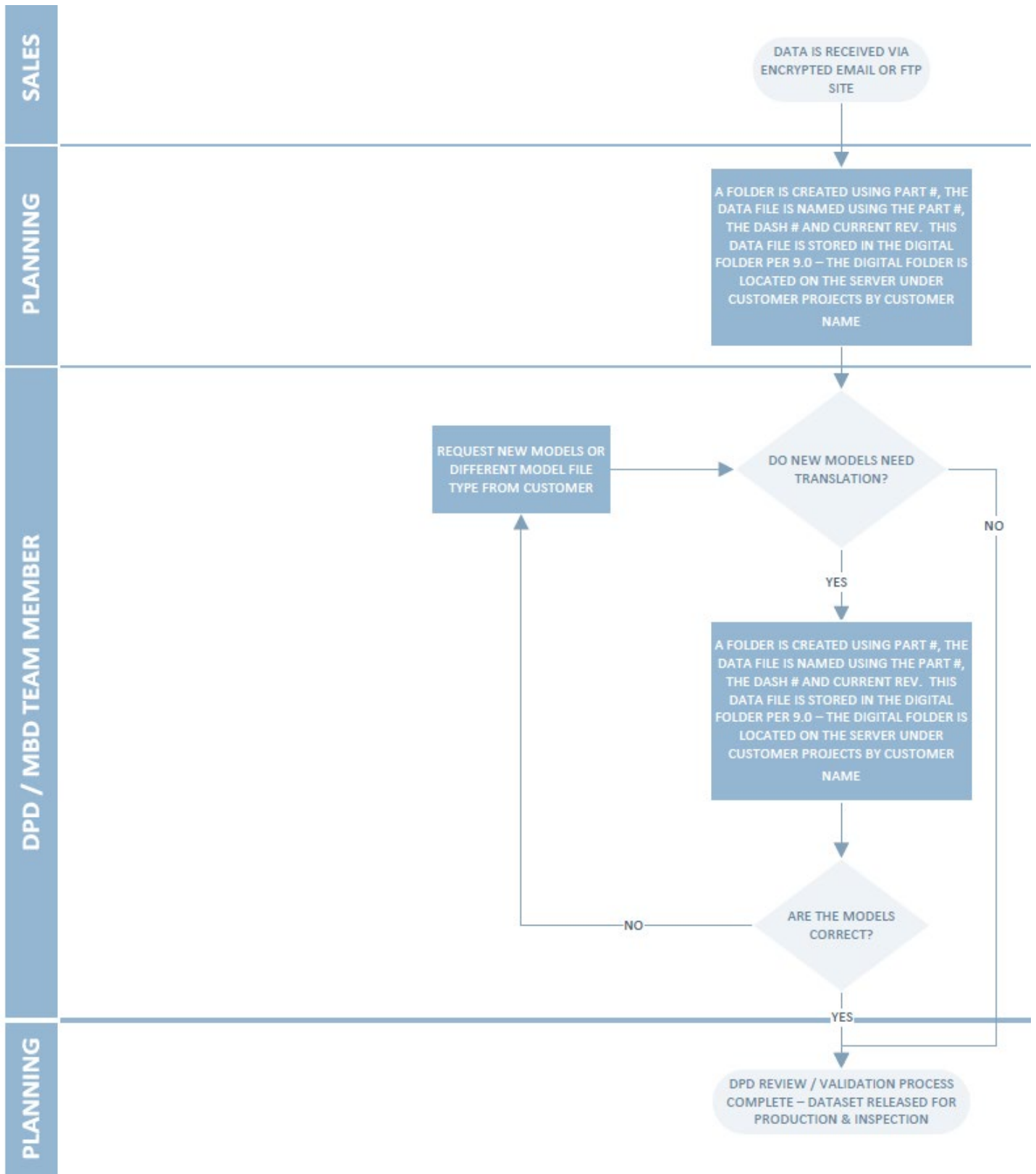


## 1.0 INTRODUCTION

- 1.1 THIS DPD / MBD (DIGITAL PRODUCT DEFINITION / MODEL BASED DEFINITION) QUALITY ASSURANCE PROCESS GOVERNS RECEIPT, USAGE, AND DISTRIBUTION OF PRODUCT DEFINITION DATASETS. IT DEFINES THE DETERMINATION AND IDENTIFICATION OF AUTHORITY DATASETS, AND PROCEDURES TO ASSURE VALID CONFIGURATION THROUGHOUT ALL OPERATIONS UTILIZING DIGITAL DATA. THIS PROCESS DEFINES THE REQUIRED DOCUMENTATION OF DIGITAL OPERATIONS AND THE RESPONSIBILITIES OF QUALITY ASSURANCE PERSONNEL FOR CONTROL OF THEM.
- 1.2 THIS PROCESS MEETS **METALTECH** CUSTOMER REQUIREMENTS CONTAINED IN REFERENCED DOCUMENTS AND CONTAINS THE MINIMUM DPD / MBD REQUIREMENTS FOR **METALTECH** SUPPLIERS. ALL CUSTOMER DPD / MBD REQUIREMENTS, PER THE CUSTOMER CONTRACT / PURCHASE ORDER MUST BE MET BEFORE ANY PRODUCTS MAY BE ACCEPTED WITH DIGITAL INSPECTION.
- 1.3 THE **METALTECH** DPD / MBD QUALITY ASSURANCE REPRESENTATIVE IS RESPONSIBLE TO INTERFACE WITH CUSTOMERS AND SUPPLIERS AS REQUIRED TO MAINTAIN TECHNICAL COORDINATION AND QUALITY CONTROL OF DIGITAL PRODUCT.
- 1.4 THE **METALTECH** QUALITY MANAGER HAS FULL RESPONSIBILITY FOR MAINTENANCE, REVISIONS, ADDITIONS OR DELETIONS TO THIS PROCESS. CUSTOMERS WILL BE NOTIFIED WITHIN 30 DAYS TO ANY CHANGES TO PROCESSES, CAD/CAM/CAI SOFTWARE, AND MEASUREMENT EQUIPMENT. THE QA MANAGER IS RESPONSIBLE TO REVISE THE PROCESS AS REQUIRED FOR CONTROL OF NEW DPD / MBD OPERATIONS, AND FOR TIMELY COMMUNICATION OF CHANGING REQUIREMENTS WITH CUSTOMERS, SUPPLIERS, AND REGULATORY AGENCIES AS REQUIRED TO MAINTAIN CONTROL OF DIGITALLY DEFINED PRODUCT.
- 1.5 THIS DOCUMENT ALSO DESCRIBES THE VALIDATION AND CERTIFICATION OF ALL HARDWARE AND SOFTWARE USED TO MANAGE AND STORE ALL DPD / MBD DATA FROM ALL METALTECH CUSTOMERS. SOFTWARE LIST CAN BE FOUND ON A SEPARATE DOCUMENT, **FORM F-110 SOFTWARE INVENTORY**.
- 1.6 THE FOLLOWING FLOW DIAGRAM GRAPHICALLY DEPICTS THE **METALTECH** FLOW OF DATA THROUGH THE MANUFACTURING AND INSPECTION PROCESSES FROM RECEIPT OF DPD / MBD DATA THROUGH ALL ORGANIZATIONS CREATING DERIVATIVES.

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DATASET NAME, EXTENSION, REVISION LEVEL, AND ANY ADDITIONAL UNIQUE CUSTOMER IDENTIFICATION TRACING BACK YOU THE AUTHORITY DATASET. IF THESE DERIVATIVES ARE REVISED REVISION LEVEL WILL BE IDENTIFIED.

- 2.2 PLANNING / PROGRAMMING SAVE DATASETS IN THE CUSTOMER PROJECTS FOLDER ONLY AFTER THEY HAVE FULFILLED THE REQUIREMENTS OF THIS DOCUMENT IN SECTION 9.0 (CUSTOMER DATASETS). THE DPD / MBD DATA USERS DO NOT HAVE WRITE ACCESS TO THE CONTROLLED DOCUMENTS FOLDERS.
- 2.3 REVISION LEVEL IN CURRENT PRODUCTION OF RELEASE DATASETS IS IDENTIFIED ACCORDING TO PROCEDURE P-750. RELEASE DATASETS CONTAINING REFERENCE ONLY GEOMETRIC ELEMENTS WILL BE CLEARLY IDENTIFIED.
- 2.4 PLANNING / PROGRAMMING WILL MAINTAIN IDENTIFICATION OF DATASETS INCLUDING DATASET REVISION LEVEL AND AUTHORITY DATASET EXTENSION (FILE TYPE).
- 2.5 RELEASED TOOL DESIGN DATASETS ARE STORED IN THE CUSTOMER PROJECTS FOLDER AND INCLUDE IDENTIFICATION OF AUTHORITY SOURCE (I.E. PROGRAMMER INFORMATION).
- 2.6 QUALITY ASSURANCE WILL PERIODICALLY REVIEW DPD / MBD DATA STORAGE PLANNING / PROGRAMMING WILL CONTROL STORAGE AND IDENTIFICATION INCLUDING REVISION LEVEL OF ALL DERIVATIVE DATASETS USED FOR PART AND TOOL ACCEPTANCE.
- 2.7 DATASETS ARE BACKED UP ACCORDING TO PROCEDURE P-750.
- 2.8 **METALTECH** WILL CONDUCT REVIEWS FOR ALL CUSTOMER DESIGN CHANGES FOR ALL DATASETS AND DATASET DERIVATIVES AND PROVIDE UPDATED CONFIGURATION MANAGEMENT THROUGHOUT MANUFACTURING, INSPECTION, AND PROCUREMENT ORGANIZATION AS NECESSARY OR WITH EACH NEW REVISION.
- 2.9 DERIVATIVE MEDIA CLEARLY INDICATES AUTHORITY SOURCE (I.E. METALTECH TITLE BLOCK) AND ALL OTHER DERIVATIVES USED FOR ITS CREATION.

### 3.0 PRODUCT ACCEPTANCE SOFTWARE (PAS)

- 3.1 PRIOR TO USE FOR PRODUCT ACCEPTANCE, NEW PAS OR UPDATED / UPGRADED WILL BE TESTED INDEPENDENTLY OF DEVELOPER AND TEST DOCUMENTATION RETAINED.
- 3.2 OBSOLETE SOFTWARE VERSIONS ARE REMOVED FROM USER ACCESS. ACCESS TO OPERATIONAL PAS IS RESTRICTED TO TRAINED USERS.
- 3.3 ALL PAS BY **METALTECH** SHALL BE VALIDATED AGAINST A PHYSICAL ARTIFACT AND CONTROLLED PER P-715, CONTROL OF MONITORING AND MEASURING EQUIPMENT.

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#### 4.0 INTERNAL QUALITY AUDIT

4.1 **METALTECH** DPD / MBD IS AUDITED TO EACH SECTION OF THIS DOCUMENT PER PROCEDURE P-920.

4.2 **METALTECH** INTERNAL QUALITY AUDIT PROCEDURES MAY INCLUDE PROVISIONS FOR AUDITING ALL OPERATIONS AFFECTING DPD / MBD DATA AND RELATED DOCUMENTATION TO ASSURE COMPLIANCE WITH CONTRACTUAL REQUIREMENTS, SOFTWARE AND PRODUCTION PART QUALITY STANDARDS, AND THE OBSERVANCE OF SECURITY RESTRICTIONS. THE AUDIT PROCESS MAY INCLUDE PROVISIONS FOR AUDIT OF SUPPLIERS USING DPD / MBD DATA ON PRODUCTS AND TOOLING.

4.2.1 AUDIT RESULTS ARE REVIEWED FOR PROCESS AND EQUIPMENT CHANGES, PROCESS AND PROCEDURE UPDATE, AND PROCESS IMPROVEMENT AS NEEDED

#### 5.0 PROBLEM REPORTING AND CORRECTIVE ACTION

5.1 **METALTECH'S** DOCUMENTED POLICY P-1020 FOR CORRECTIVE ACTION SHALL INCLUDE REPORTING, TRACKING AND RESOLVING ALL TRANSMISSION, HARDWARE, SOFTWARE AND DATASET PROBLEMS AND PRODUCT DEFICIENCIES.

5.2 NONCONFORMING DATASETS, INCLUDING THOSE RECEIVED FROM CUSTOMERS, ARE IDENTIFIED AND REMOVED FROM PRODUCTION USE.

#### 6.0 CONTROL OF DIGITAL DATA USED BY SUPPLIERS AND SUB-TIER SUPPLIERS

6.1 **METALTECH** WILL IDENTIFY DPD / MBD CAPABLE SUPPLIERS ON THEIR APPROVED SUPPLIER LIST WHEN DATASETS ARE PROVIDED FOR MANUFACTURING, INSPECTION, INCLUDING CMS SERVICE SUPPLIERS, OR TOOL DESIGN OR TOOL BUILD AND COMPLY WITH REQUIREMENTS OF D6-51991.

6.1.1 D6-51991 REQUIREMENTS WILL BE FLOWED DOWN IN PURCHASE DOCUMENTS WHEN DIGITAL DATA IS PROVIDED TO SUPPLIERS.

6.1.2 **METALTECH** SUPPLIERS MUST DEMONSTRATE COMPLIANCE WITH THE APPLICABLE SECTIONS OF THIS DOCUMENT AND **METALTECH** CUSTOMER REQUIREMENTS. **METALTECH** AUDITS SUPPLIERS, ENSURES COMPLIANCE OF SUB-TIERS, AND RETAINS EVIDENCE OF SUPPLIER COMPLIANCE.

6.2 **METALTECH** CUSTOMERS HAVE THE RIGHT TO SURVEY AND/OR REVIEW THE DPD / MBD QUALITY ASSURANCE AND CONFIGURATION MANAGEMENT SYSTEMS OF SUPPLIERS.

#### 7.0 MEASUREMENT AND TEST EQUIPMENT

7.1 ALL EQUIPMENT UTILIZED FOR PRODUCT ACCEPTANCE INSPECTION IS CALIBRATED AND CERTIFIED ACCORDING TO P-715.

7.2 COORDINATED MEASURING MACHINE'S ARE CERTIFIED ACCORDING TO P-715.

7.3 IN THIS SECTION **METALTECH** DOCUMENTS ITS OPERATING PROCEDURES AND INTERNAL CONTROLS FOR **METALTECH** AND THEIR SUPPLIERS USE OF PORTABLE COORDINATED MEASUREMENT SYSTEMS.

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- 7.3.1 METALTECH USES AN ARTICULATING ARM DURING IN-PROCESS AND FINAL INSPECTION.
- 7.3.2 CALIBRATION AND MAINTENANCE OF THIS TOOL IS CONTROLLED BY PROCEDURE P-715 AND BY A PROVIDER THAT MEETS ALL CALIBRATION REQUIREMENTS OF THE MANUFACTURER (OEM). IT IS ACCEPTABLE TO UTILIZE THE ARTICULATING ARM TO MEASURE FEATURES WITH ENGINEERING TOLERANCE AT LEAST 5X THE VOLUMETRIC PERFORMANCE TEST RESULTS OF LAST CALIBRATION AND 2X THE LARGEST FIELD CHECK DEVIATION.
- 7.3.3 PRODUCT ACCEPTANCE SOFTWARE (PAS) IS VALIDATED PER PROCEDURE P-715.
- 7.3.4 THE ARM COORDINATE LOCATION IS CHECKED PRIOR TO THE BEGINNING OF EVERY PART CHECK SEQUENCE INCLUDING FLAT PLANE ORIENTATION ALL WITHIN A TOLERANCE OF +/- .002.
- 7.3.5 COORDINATE SYSTEMS ESTABLISHED AND CHECKED AT THE BEGINNING OF EVERY PART CHECK SEQUENCE. THE ACCEPTABLE COORDINATE SYSTEM IS A PHYSICAL "3-2-1" TYPE ALIGNMENT REFERENCING THE DATUM STRUCTURE IN THE CUSTOMER SUPPLIED DATA.
- 7.3.6 WHEN METALTECH NEEDS TO USE IT'S PORTABLE CMS IN A SETUP THAT REQUIRES MULTIPLE SETUP STATIONS THE OPERATION OF THE MOVING AND SETUP OF EACH POSITION IS CONTROLLED BY CHECKING A MINIMUM OF 7 POINTS SPREAD OUT ACROSS THE PORTABLE CMS ENVELOPE OF 7-1/2FT DIA. NOT TO EXCEED THAT DIA. IT IS ACCEPTABLE TO UTILIZE MULTIPLE SETUP STATION TO MEASURE FEATURES WITH AN ENGINEERING TOLERANCE AT LEAST 4X THE LARGEST FIELD CHECK DEVIATION. IT IS RECOMMENDED THAT THE PART BE CHECKED TWICE.
- 7.3.7 DATA COLLECTION PARAMETERS THE DENSITY AND SPREAD OF CONTACT POINTS MUST BE SUFFICIENT TO INDICATE ACTUAL FEATURE DIMENSIONS. MEASUREMENT COMMANDS AND REPORTS MUST BE CORRESPOND TO THE ENGINEERING REQUIREMENTS (GD&T PROFILE AND POSITION)
- 7.3.8 REPORTS ARE TO BE CREATED IN A VISUAL FORMAT WITH A CLEAR REPRESENTATION OF THE OF THE CONTACT POINTS NUMBERING SYSTEM WITH THE ACTUAL, NOMINAL AND DEVIATION VALUES DEFINED, DATUM FEATURES AND INSPECTED FEATURES. SEE METALTECH DOCUMENT F-068 ARTICULATING ARM INSTRUCTION SHEET.
- 7.3.9 ALL RECORDS AND REPORTS ARE TO BE SAVED IN THE INSPECTION REPORTS FOLDER UNDER THE QUALITY ASSURANCE FOLDER ON THE SERVER, WITH TRACEABILITY TO THE AUTHORITY DATA SET WITH REV LEVEL.
- 7.3.10 TRAINING OF THE ARTICULATING ARM BY QUALITY ASSURANCE INCLUDING A MINIMUM OF 3 DAYS OJT AND A GD&T OVERVIEW. USAGE OF THE PORTABLE CMS IS CONTROLLED BY PROCEDURE AND F-068 ARTICULATING ARM INSTRUCTION SHEET.

## 8.0 INSPECTION MEDIA FROM DATASETS

- 8.1 METALTECH QA PERSONNEL COORDINATE WITH OTHER DEPARTMENTS REVIEWING THE ENTIRE MANUFACTURING CYCLE OF EACH PRODUCT AND DETERMINING EFFECTIVE LOCATIONS AND METHODS OF INSPECTION OF EACH PRODUCT FEATURE.
- 8.2 FOR ALL REDUCED CONTENT AND MBD DATASETS, METALTECH QA PERSONNEL ENSURE THAT ALL PRODUCT FEATURES ARE IDENTIFIED FOR SUFFICIENT INSPECTION OPERATION FOR VALIDATION TO DESIGN REQUIREMENTS.
- 8.3 INSPECTION INCLUDES TEXTUAL DESCRIPTION OF INSPECTION OPERATION AND 3D OR 2D ILLUSTRATIONS OF PRODUCT FEATURES TO BE INSPECTED. INSPECTION PLANS ARE AUTHORIZED BY METALTECH QA PERSONNEL WHENEVER AN INSPECTION OPERATION REQUIRES INFORMATION SUPPLEMENTAL TO AND DERIVED FROM THE AUTHORITY DATASET. SEE ATTACHMENT A DRAWING DERIVATIVE TEMPLATE.

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- 8.4 METALTECH QA PERSONNEL ARE RESPONSIBLE FOR ACCEPTANCE OF ALL EXTRACTED INSPECTION MEDIA USED FOR PRODUCT ACCEPTANCE. INSPECTION PLAN AND INSPECTION DATASETS ARE STORED IN QA DIRECTORIES.
- 8.5 TYPICAL SURFACE AND FEATURE MEASUREMENT FOR CMS DATA COLLECTION IS PERFORMED ACCORDING TO CMS DATA COLLECTION INSPECTION POINTS (ATTACHMENT B).
- 8.6 DATA AND DATASETS IDENTIFIED AS REFERENCE ONLY MAY NOT BE USED FOR PRODUCT ACCEPTANCE.
- 8.7 WHEN PLANNING MEASUREMENTS FOR FAI ARE REQUIRED, QA WILL VERIFY THAT ALL EXPLICIT AND IMPLICIT DESIGN REQUIREMENTS ARE IDENTIFIED AND PLANED FOR INSPECTION/VALIDATION. EXAMPLES INCLUDE: ALL FEATURES DEFINED BY FEATURE CONTROL FRAMES, ANNOTATION, NOTES AND OTHER SPECIFIED REQUIREMENTS IN THE AUTHORITY DPD / MBD DATASET AND ASSOCIATED PARTS LIST, INCLUDING DIMENSIONAL AND OTHER PROPERTIES.

**9. DATA EXCHANGE METHODS**

- 9.1 DATASETS RECEIVED FROM METALTECH CUSTOMERS TO BE USED BY METALTECH CAD SYSTEM WILL BE VISUALLY INSPECTED FOR MISSING ELEMENTS AND/OR INFORMATION. DATASETS MISSING ANY INFORMATION WILL BE MARKED AND SEGREGATED UNTIL IT CAN BE REPLACED BY METALTECH’S CUSTOMER.
- 9.2 WHEN METALTECH TRANSLATES DATASETS FROM THE ORIGINAL NATIVE CAD SYSTEM TO MANUFACTURING OR INSPECTION SOFTWARE, THE TRANSLATION MUST BE VERIFIED. THE VERIFICATION PROCESS WILL INCLUDE VALIDATION BACK TO THE AUTHORITY DATASET AND OBJECTIVE EVIDENCE OF COMPLETION USING THE METHODS PER SECTION 9.5.
- 9.3 WHEN CUSTOMER DPD / MBD DATA CONTAINING 2D AND 3D GEOMETRY IS RECEIVED IN TRANSLATED FORMAT (E.G., .STP), METALTECH VERIFIES THE DATASET AND STORES THE DATA IN THE APPROPRIATE DIRECTORY MAKING IT AVAILABLE TO THE QA AND MANUFACTURING DEPARTMENTS.
- 9.4 METALTECH WILL VERIFY AND VALIDATE THEIR TRANSLATION SOFTWARE (PER SECTION 3.), IN ORDER TO MAINTAIN AUTHORITY STATUS.
- 9.5 TRANSLATION - DATASETS NOT IN A FORMAT THAT CAN BE USED FOR MANUFACTURE BY METALTECH OR IT’S SUPPLIERS WILL NEED TO BE TRANSLATED. IN THE NEXT SECTIONS METALTECH WILL DESCRIBE THE TRANSLATION AND VERIFICATION PROCESS.
  - 9.5.1. METALTECH TRANSLATES ALL CATIA FILES TO A USABLE FILE FORMAT COMPATIBLE WITH OUR CAD / CAM SOFTWARE.  
THE FILE NAME / REV STAYS THE SAME BUT CHANGING THE FILE TYPE TO THE TRANSLATED EXTENSION. THE FILE IS SAVED WITH THE EXACT FILE NAME AS THE AUTHORITY DATA WITH THE REV LEVEL IN THE TRANSLATED FOLDER UNDER THE CONTROLLED DOCUMENTS DIRECTORY.
  - 9.5.2. VERIFICATION OF TRANSLATED DATA IS ACHIEVED USING ANY ONE OF THESE 3 METHODS:
    - 1. **POINT CLOUD** – POINTS IN A .500 WIDE GRID PATTERN ARE CREATED ON ALL 6 SIDES OF THE 3D PART THEN PROJECTED ONTO THE 3D PART. THE PROJECTED POINTS ARE THEN SAVED IN THE STEP FORMAT. THE POINTS IN STEP FORMAT ARE THEN OVERLAID ONTO THE NATIVE PART WITHIN THE NATIVE CAD SYSTEM AND ANALYZED AGAINST THE NATIVE CUSTOMER 3DPART. CHECKING THAT

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ALL ANNOTATIONS AND FEATURE FRAMES USED FOR INSPECTION ARE ACCOUNTED FOR AND WERE NOT ALTERED. IF THE POINTS ARE WITHIN .001 FROM THE 3D PART THEN THE TRANSLATION WAS SUCCESSFUL AND THE VERIFICATION FILE WITH BOTH THE AUTHORITY DATASET AND THE POINTS OVERLAID ON IT IS SAVED IN THE TRANSLATED FILES DIRECTORY WITH THE TRANSLATED STEP FILE.

2. **VALIDATION SOFTWARE** – VALIDATION IS ACHIEVED USING SOFTWARE VALIDATION TOOL. THIS SOFTWARE PREFORMS A CHECK AGAINST ALL 3D FEATURES AND ANNOTATIONS OF THE TRANSLATED DATA TO THE AUTHORITY DATA SET AUTOMATICALLY. WHEN IT IS COMPLETE IT PRINTS OUT A PASS OR NO PASS REPORT. THE REPORT IS SAVED WITH THE TRANSLATED DATA IN THE TRANSLATED FILES DIRECTORY.
3. **HAND ANALYZE CHECK** – THE 2 DATA FILES CAN BE OVERLAID OVER EACH OTHER AND ANALYZED TO EACH OTHER CHECKING EACH FACE, SURFACE, LINE, CURVE AND\OR POINT TO THE AUTHORITY DATASET. ALSO DOING A DIMENSIONAL CHECK ON ALL AREAS OF THE TRANSLATED DATA TO THE AUTHORITY DATASET. CHECKING THAT ALL ANNOTATIONS AND FEATURE FRAMES USED FOR INSPECTION ARE ACCOUNTED FOR AND WERE NOT ALTERED.

9.5.3 RESULTS OF CAD TRANSLATION VERIFICATIONS WILL BE TRACKED AND ANALYZED FOR POTENTIAL REDUCED SCOPE BASED ON PROCESS STABILITY AND MANAGEMENT OF DEMONSTRATED RISK.

- 9.6 SENDING OF DATA - DATASETS THAT WILL BE SENT TO SUB TIER SUPPLIERS WILL BE SENT IN THE TRANSLATED AND VERIFIED FORM INSIDE A SECURE CLOUD BASED FILE SHARING SYSTEM, SUCH AS MICROSOFT ONEDRIVE OR DROPBOX TO ENSURE THE DATA IS NOT CORRUPTED IN THE TRANSFER.

## 10.0 SPECIALTY TOOLING

- 10.1 ALL METALTECH TOOL DESIGN AND TOOL INSPECTION DATASETS COMPLY WITH DERIVATIVE REQUIREMENTS OF THIS DOCUMENT SECTION 8.0.
- 10.2 ALL METALTECH DIGITALLY DEFINED TOOLS AND PHYSICAL TEMPLATES ARE TRACEABLE TO AUTHORITY SOURCE. METALTECH QA INDICATES ACCEPTANCE OF TOOLS AND TEMPLATES AND DETERMINES AND DOCUMENTS SCOPE AND FREQUENCY OF PERIODIC RE-INSPECTION.

## 11.0 TRAINING AND PROCESS PERFORMER

- 11.1 ALL DPD / MBD SYSTEM USERS MUST BE TRAINED ON THIS PROCEDURE, AND A GD&T OVERVIEW AND ALL CHANGES DRIVEN BY NEW EQUIPMENT, SOFTWARE OR BOEING PROGRAM REQUIREMENTS. SEE ALSO SECTION 8.4 FOR PERSONNEL AUTHORIZED TO RELEASED EXTRACTED INSPECTION MEDIA.
- 11.2 ALL FORMAL METALTECH DPD / MBD EQUIPMENT USERS' TRAINING RECORDS (INCLUDING ON THE JOB TRAINING) ARE RETAINED PER PROCEDURE P-720. INFORMAL AND O.J.T. TRAINING IS NOT RECORDED.

## DEFINITIONS

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**AUTHORITY DATASET** - A DATASET WHICH PROVIDES THE UNDISPUTED SOURCE FOR PRODUCT ACCEPTANCE TO APPROVED TYPE DESIGNS. IT IS UNDER CONFIGURATION MANAGEMENT WITH ACCESS, RELEASE, AND CHANGE CONTROLS IN PLACE TO ENSURE DEFINITION INTEGRITY.

**COORDINATE MEASUREMENT SYSTEM** - COMPUTER AIDED MEASUREMENT DEVICE THAT COLLECTS 3D DATA FROM PHYSICAL ARTICLES.

**CAD - COMPUTER AIDED DESIGN** - (1) ANY COMPUTER SYSTEM OR PROGRAM THAT SUPPORTS THE DESIGN PROCESS. (2) THE USE OF COMPUTERS TO ASSIST ENGINEERING DESIGN IN DEVELOPING, PRODUCING, AND EVALUATING DESIGN, DATA AND DRAWINGS.

**DERIVATIVE** - A REPRODUCTION OF ALL OR PART OF AN AUTHORITY DATASET. DERIVATIVES INCLUDE PAPER AND MYLAR PLOTS, TOOL DESIGNS, INSPECTION DATASETS CREATED TO ANALYZE AS-BUILT DESIGNS, CHECK TEMPLATES, NUMERICAL CONTROL (N/C) DATASETS/MEDIA, DATASETS WITH NOMINAL VALUES FOR CMS USE, QA INSPECTION PROCESSES AND OTHER EXTRACTIONS (DIMENSIONS, VIEWS, ETC.) FOR INSPECTION/MEASUREMENT USE.

**DPD / MBD - DIGITAL PRODUCT DEFINITION** – THE ELECTRONIC DATA ELEMENTS THAT SPECIFY THE GEOMETRY AND ALL DESIGN REQUIREMENTS FOR A PRODUCT (INCLUDING NOTATION AND PARTS LISTS), AND THE USE OF THIS DATA THROUGHOUT AN INTEGRATED SYSTEM USING COMPUTER AIDED DESIGN, COMPUTER AIDED MANUFACTURING, AND COORDINATE MEASUREMENT SYSTEMS. ALSO KNOWN AS CAD/CAM SYSTEM.

**FEATURE** - ANY HARDWARE DESIGN ATTRIBUTE OR CHARACTERISTIC. THIS INCLUDES PHYSICAL PORTIONS OF HARDWARE SUCH AS A SURFACE, FACE, EDGE, RADIUS, HOLE, TAB, SLOT, PIN, ETC., AND REQUIREMENTS SUCH AS NON-DESTRUCTIVE INSPECTION (NDI) AND INTERCHANGEABILITY AND REPLACEABILITY (I&R). ALL FEATURES REQUIRE VALIDATION TO CONFORM THE PRODUCT TO THE DESIGN AUTHORITY. ALL FEATURES HAVE ASSOCIATED NOTES AND/OR GEOMETRIC DIMENSIONING AND TOLERANCING FEATURE CONTROL FRAMES (FCF). BUT ONE NOTE OR FCF MAY REFER TO SEVERAL FEATURES.

**FEATURE REQUIREMENTS LIST** - A LIST OF ALL TOLERANCE REQUIREMENTS CONTAINED IN A REDUCED CONTENT DATASET, WITH UNIQUE IDENTIFIERS.

**IGES** - INITIAL GRAPHICS EXCHANGE STANDARD - A NATIONAL BUREAU OF STANDARDS CAD/CAM GRAPHICS DATABASE EXCHANGE FILE FORMAT, WHICH PERMITS GRAPHICS FILES FROM DISSIMILAR COMPUTER SYSTEMS TO BE EXCHANGED.

**INSPECTION PLAN** - A DESCRIPTION OF 2D AND/OR 3D COMPUTER GENERATED INSPECTION MEDIA/METHODS, DERIVED FROM AUTHORITY DPD / MBD DATASETS, USED TO COMMUNICATE INSPECTION REQUIREMENTS AND MEDIA USAGE TO MANUFACTURING AND INSPECTION AREAS. TYPICAL INSPECTION VIEWS INCLUDE ENGINEERING AND PROCESS CONFIGURATION/TRACEABILITY, OVERLAY/SETUP INSTRUCTIONS, AND A LIST AND/OR GRAPHIC REPRESENTATION OF THE FEATURES TO BE INSPECTED.

**NC - NUMERICAL CONTROL** – ELECTRONIC MEDIA AND PROCESS USED TO MANUFACTURE PRODUCTS. ALSO KNOWN AS CAM – COMPUTER AIDED MANUFACTURING.

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**PAS - PRODUCT ACCEPTANCE SOFTWARE** - DPD / MBD SOFTWARE (INCLUDING CAD, LEV, DATA EXCHANGE, AND CMS SYSTEMS) USED TO INSPECT AND ACCEPT PARTS, ASSEMBLIES, TOOLING, AND SYSTEMS. (NOTE: NOT EMBEDDED OR LOADABLE AIRBORNE S/W)

**REDUCED CONTENT DATASET** - ANY DPD / MBD DESIGN DATASET WITHOUT FULL DIMENSIONING OF PRODUCT FEATURES ON A 2D SHEET. THIS FORMAT MAY OR MAY NOT INCLUDE ON OR MORE 2D SHEETS. MODEL BASED DEFINITION (MBD) IS ONE TERM USED TO DESCRIBE A DATASET WITHOUT 2D SHEETS.

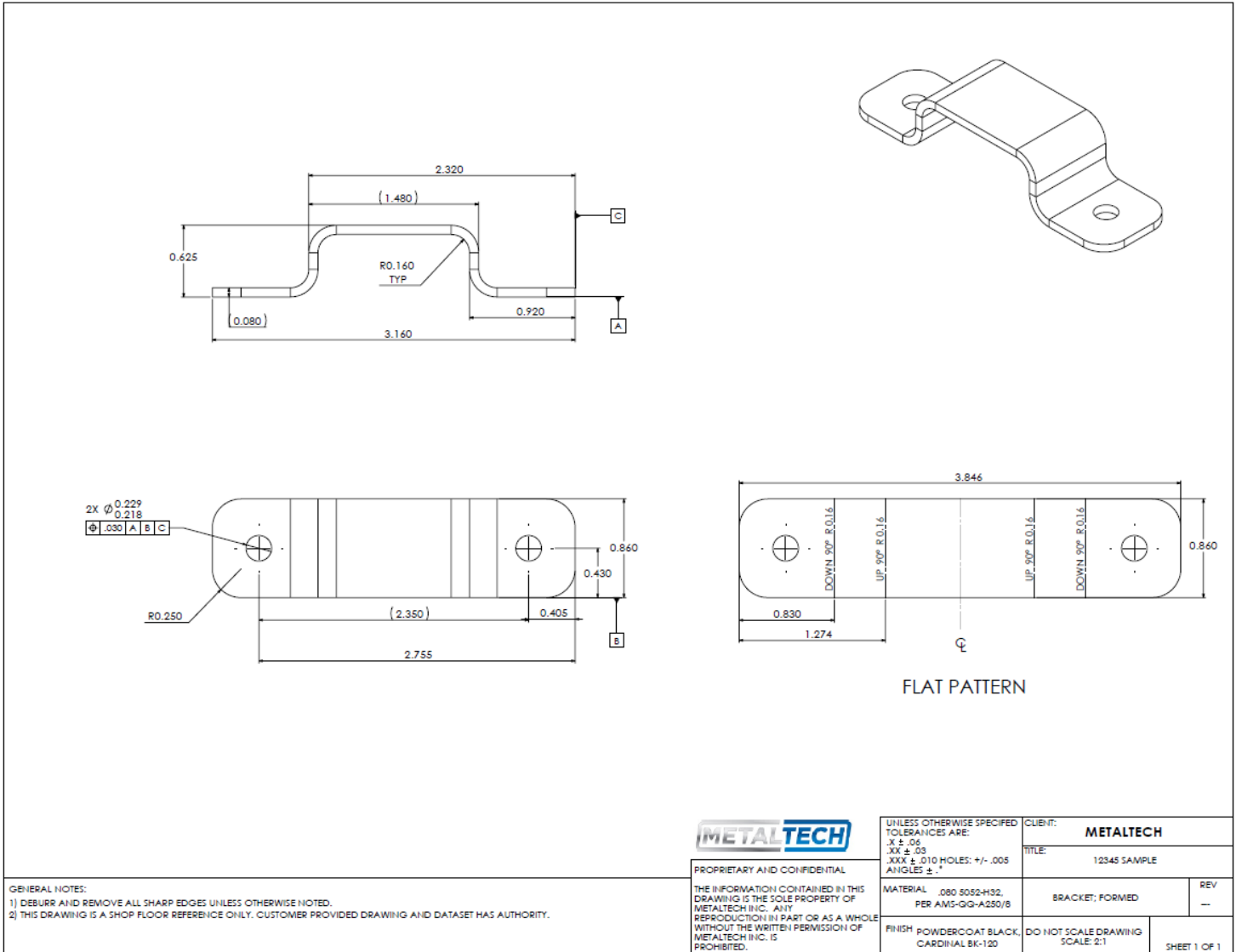
**STEP** - STANDARD TECHNICAL EXCHANGE PROTOCOL. AN INTERNATIONAL STANDARDS OR **ORGANIZATION** STANDARD FOR COMPUTER-INTERPRETABLE REPRESENTATION AND EXCHANGE OF PRODUCT DATA. USED TO EXCHANGE DATASETS BETWEEN DISSIMILAR COMPUTER SYSTEMS.

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ATTACHMENT A

DRAWING DERIVATIVE TEMPLATE



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**ATTACHMENT B****STANDARD MEASUREMENT VERIFICATION GUIDELINES**

USE OF AN INSPECTION POINT GRID IS FAVORABLE FOR FIRST ARTICLE INSPECTION OR FOR FIRST PART TRYOUT OF N/C MACHINING PROGRAMS AND CORRESPONDING CMM INSPECTION PROGRAMS. USE OF THE GRID WILL ENSURE GOOD INSPECTION POINT COVERAGE OF MACHINED FEATURES FOR THE FIRST PARTS CREATED AND ASSIST IN PROCESS FEEDBACK AND IMPROVEMENT UNTIL THE N/C PRODUCTION STAGE BEGINS.

WHEN FEATURES TYPES HAVE SURFACE AREAS OF GREATER THAN 4 X 4 INCHES, BUT UNDER 8 FEET IN LENGTH OR WIDTH, AN INSPECTION POINT GRID OF APPROXIMATELY 1 POINT EVERY 4 SQ. INCHES SHOULD BE PLACED ON THE FEATURE. FOR FEATURES GREATER THAN 8 FEET IN LENGTH OR WIDTH, AN INSPECTION POINT GRID OF 1 POINT FOR EVERY 6 SQ. INCHES SHOULD BE PLACED ON THE FEATURE.

IN ADDITION, INSPECTORS WILL CONSIDER PRODUCT MANUFACTURING PROCESSES AND ADD INSPECTION POINTS AS NEEDED TO VERIFY CONFORMANCE TO THE DESIGN. FOR EXAMPLE, PROCESSES WITH PERPENDICULAR OR FLATNESS TOLERANCES WILL REQUIRE ADDITIONAL POINTS FOR A COMPLETE ANALYSIS OF THE DESIGN FEATURE.

• FEATURE TYPE	MINIMUM NUMBER OF POINTS
• LINE	2
• PLANE	3
• SURFACE (+/- .010 TO .021)	5 POINTS (ADD PTS. PER POINT GRID CRITERIA ABOVE)
• SURFACE (GREATER THAN 5 SQ. IN.)	5 (SEE INSPECTION POINT GRIDS ABOVE)
• SURFACE (LESS THAN 2 SQ. IN.)	3 POINTS
• SURFACE (>10 DEGREES CONTOUR)	5 POINTS + POINTS SPACED AT EVERY 10 DEGREES OF CONTOUR
• TANGENT SURFACES	ADD POINTS PER INSP.
• CURVES (LESS THAN 5 INCHES)	3 POINT MINIMUM OR 1 PT PER INCH
• CURVES (GREATER THAN 5 INCHES)	5 POINT MINIMUM OR 1 PT. PER 6 IN. (SEE POINT GRID ABOVE)
• RADIUS	3

**ADDITIONAL CONSIDERATIONS**

INDIVIDUAL SURFACES - POINTS ADDED .250 TO .500 FROM THE NOMINAL EDGES OF THE INDIVIDUAL SURFACES

TANGENT SURFACES – (FACES, PATCHES, TANGENT SURFACES/PROCESSES, ETC.) – INSPECTION POINTS ARE ADDED AT APPROXIMATELY ONE INCH ON EITHER SIDE OF SURFACE INFLECTIONS, AND AT THE TANGENCY BETWEEN SURFACES.

RADIUS - WHEN A RADIUS IS INSPECTED BY ONLY ONE POINT, IT IS ASSUMED THE SURFACE IN CONTACT WITH THE RADIUS HAS BEEN INSPECTED AND IS IN TOLERANCE. ALSO, THE DESIGN SHOULD INDICATE THERE IS MORE TOLERANCE ALLOWED (USUALLY DOUBLE) THAN THE CONTACTING SURFACE. IN MOST CASES, RADIUS FEATURES ARE QUICKLY AND ADEQUATELY INSPECTED USING A PHYSICAL RADIUS GAUGE, AND NOT INCLUDED AS PART OF CMM INSPECTION PROGRAMS. HOWEVER, INSPECTIONS OF RADIUS FEATURES CAN BE ADDED TO A CMM PROGRAM USING THE ONE POINT SCENARIO TO ENSURE THE CORRECT CORD HEIGHT RADIUS HAS BEEN CREATED ON THE PRODUCT. ONE POINT WILL ALSO IDENTIFY IF THE LOCATION OF THE RADIUS IS WITHIN TOLERANCE.

INSPECTION POINTS ARE REQUIRED FOR THE CENTER OF TOOLING HOLES, SCRIBE LINES (TRIM, CROSSHAIR, ETC.), DATUM PROCESSES, AND TOOLING SURFACES (PROCESSES). IN ALL CASES, THE CMM INSPECTION SHOULD BEGIN WITH

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AN INSPECTION OF EACH SETUP SKETCH DATUM TO DOCUMENT AT THE SETUP IS VALID, WITHOUT SEARCHING THROUGH THE CMM PRINTOUT FOR THOSE DATUM FEATURES.

IN ALL CASES, WHEN ANY FEATURE IS OUT-OF-TOLERANCE, ADDITIONAL INSPECTION POINTS NEED TO BE CREATED AROUND THE DISCREPANT AREA TO DETERMINE THE FULL EXTENT OF THE OUT-OF-TOLERANCE CONDITION ON THE FEATURE.

**PRODUCTION INSPECTION**

WHEN N/C PROGRAMS HAVE COMPLETED THE INITIAL RUN PROCESS, AND A CMS PROGRAM HAS VERIFIED AN ACCEPTABLE FAI OF THE PRODUCT, THE NUMBER OF FAI INSPECTION POINTS SHOULD BE REDUCED FOR "PRODUCTION" INSPECTIONS. PRODUCTION INSPECTIONS MUST PROVIDE ENOUGH INSPECTION POINTS TO PROVIDE FEEDBACK FOR N/C VARIABLES SUCH AS CUTTER WEAR, TOOL CHANGES OPERATIONS, ETC. INSPECTION WILL ALSO EVALUATE PRODUCT MANUFACTURING PROCESSES TO DETERMINE IF MEASUREMENTS PROVIDE ENOUGH FEEDBACK TO THE OPERATOR, AND A SUFFICIENT NUMBER OF MEASUREMENT POINTS ARE IN USE. THE NUMBER OF MEASUREMENT POINTS MAY NOT BE REDUCED BELOW THE "MINIMUM NUMBER OF POINTS" PER FEATURE LISTED ABOVE.

**Revision History**

Rev	Date	Section	Paragraph	Summary of change	Authorized by
A	05/20/2014			INITIAL RELEASE	JUSTIN EVANS – QUALITY MANAGER
B	07/15/2019	ALL	ALL	FULL REVIEW / UPDATE – INCLUDING FORMATTING / PROCEDURE CHANGE UPDATES.	JUSTIN EVANS – QUALITY MANAGER
C	07/10/2020	ALL	ALL	ADDED MBD TERMINOLOGY THROUGHOUT; UPDATED FLOW CHART, ADDED NOTE TO SOFTWARE LIST, ADDED NEW DER. DWG	JUSTIN EVANS – QUALITY MANAGER

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