



General Drawing and Manuals Specification

Global Common

SD-003

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1. Scope

The intent of this specification is to assure that all documentation for all equipment supplied to Nexteer Automotive will be consistent and available electronically throughout our Global Operations. This specification describes the requirements for machine / tooling / gaging drawings and operation / service manuals. Any deviation from this specification shall be submitted in writing and written approval obtained from the Engineer in Charge. Sample drawings are included with this document for further clarification

2. Drawing Storage System

2.1. TeamCenter Engineering (TCEng).

2.1.1. TCEng (formerly known as iMAN) is Nexteer's drawing storage system.

2.1.2. Information related to working with ME folders, etc. can be found on the Manufacturing Engineering Process and Tools website.

1. ME Folders / CAD Drawings online includes the following information:
 - a. Appropriate forms for submitting drawings to TCEng via nexteerdatabexchange.com.
 - b. Screen shots illustrating the folder download / upload process through nexteerdatabexchange.com.
 - c. Searching for and viewing folders in TCEng.
2. The information in a. and b. above is also available to suppliers on nexteerdatabexchange.com vendor documents website.

2.1.3. Data Transfer

1. At the time of machine shipment from the machine builder to Nexteer Automotive, CAD files with the appropriate naming convention (see section 2.2) shall be delivered to the Nexteer Automotive engineer in charge.
2. Final drawing files and operation and service manuals (see section 4.1) shall be submitted through nexteerdatabexchange.com to the attention of the site TCEng Gatekeeper. On the nexteerdatabexchange.com upload page:
 - a. Click on "select group"
 - b. A group list will appear
 - c. Look for: Reprographics Center – SAG
Note: Reprographics Center – SAG is now the address for submitting all files / correspondence.
 - d. Click on this address to select
 - e. Proceed with your normal steps
3. The drawing file format shall be one ZIP'd file (e.g: SS-SD123456-M.ZIP, SS-SD123456-C.ZIP, SS-TL123456.ZIP). This file shall contain all the electronic drawings named using the file naming convention in 2.2. and in the appropriate folder defined in 2.2.
4. The operation and service manual file format shall be electronic and as defined in 6.1.

2.1.4. Sample drawings to illustrate the requirements outlined in this specification are available on the Manufacturing Engineering Process and Tools website and on nexteerdatabexchange.com vendor documents website.

1. Tool drawings including:
 - a. Assembly, sub-assembly and detail drawings
 - b. Excel Drawing Parts List (DPL)
2. Controls drawings
 - a. Electrical, Pneumatic and Hydraulic
 - b. Drawing Parts List

2.2. Drawing and File Naming Convention

2.2.1. Machine M Folder - Mechanical Drawings

1. All machine mechanical drawings shall be identified by assigning the appropriate prefix and the capital equipment or expense equipment number, followed by the suffix (see table below). Prefix shall include Equipment Site Code and Folder Type in the File Name and Drawing Title Block.
2. Revisions of the original folders shall retain the original site codes, even if the equipment has been relocated to a new site. The original site code shall be retained on revised and added sheets in the Drawing Title Block. New site locations should be documented in the Folder Drawing Parts List (DPL).
3. Machine folder types:
 - a. Supplier standard machines (supplier owns the machine design Ref: SD-010) - the folder shall include at a minimum, the machine layout (foot print) and tool mounting surface layouts. All Nexteer Automotive purchased machine modifications shall be documented on Nexteer Automotive tool drawings. A complete spare parts list shall be included in the service manuals.
 - b. Nexteer Automotive owned special machines/fixtures design (Ref: SD-000) - the folder shall include a copy of the original tool assembly drawings of the machine as built, with the TL number clearly identified as a reference. Note all subsequent machines/fixtures built from these designs shall have a unique machine number and drawing folder assigned.
4. The Engineer in Charge will supply the equipment tag number for the drawings.
5. Suppliers frequently will provide drawings of various machine components and details which are standard for the manufacturer. These drawings shall be assigned the "MCH" suffix.
6. Refer to [Appendix A](#) for file naming convention examples.

Machine M Folder – Mechanical Drawings

FOLDER NAMING CONVENTION:

S(A)-(BB)123456-**M**-(drawing description)



FILE NAMING CONVENTION:

S(A)-(BB)123456-(CCC)-(DDD)-(EEE)

Key for (A) – Equipment Site Code

B – Brazil
D - Indonesia
E – Europe Tech Center
F - Wuhan
H – Suzhou
I – India
J – Juárez
M – Australia
N – Asia Tech Center (Nippon)
O - Chongqing
P – Prototype Center
Q – Querétaro
S – Saginaw
T – Tychy / Gliwice
U – Liuzhou
V - Morocco
W - Wuhu
Y – Lingyun
Z – Global Common

Historical Sites

A – Alabama
C – Cadiz
G - Strasboug
K – New Castle
L – Livorno
R – Sabinas Hidalgo
X – Mexico Tech Center

Key for (BB) – Machine M Folder Type

SD – Capital Equipment
FX – Validation Engineering
M(A) – Non-capitalized Equipment
MA – Alabama, USA
MS – Saginaw, USA

See Key for (A) for additional Site Codes

PE – Plant Engineering
PL – Plant Layout
PR – Process Equipment (Reprographics dispensed number)

Key for (CCC) – Sheet Type

MCH – Machine, layout, utility, and foundation drawings
VEN – Ventilation drawings
ASM – Assembly drawings
SUB – Sub-assembly drawings
SPA – Standard purchased altered parts
CHT – Chart
DPL – Drawing parts list
DET – Detail
GDS – All instruction guides
OSM – Operation & Service Manual
3DD – 3D Dimensional Math Data

(DDD) - Sheet number

Example: 001, 002, 003

The sheet number for Excel parts shall be DPL-000M for machine Mechanical drawings.

(EEE) - Revision level

Example: 001, 002, ... 999

999 is the revision level indicating an obsolete sheet

- 2.2.2. Tooling Folder – Mechanical Drawings (designs owned/purchased by Nexteer Automotive or a Nexteer Automotive customer).
1. Tooling folders include alloy, die tooling, gage & test equipment, and fixtures.
 2. For special machines designed for Nexteer Automotive:
 - a. Design shall be documented in one or more tool numbers as required.
 - b. Additional subassemblies may be added for tooling of different part models/numbers.
 - c. A layout drawing of the machine referring to the tool number(s) shall be included as S(A)-SD-123456-MCH-001 in the Machine M Folder.
 3. For machine design owned by the supplier, tool drawings shall be provided for the modification of their standard design (also known as SPA).
 4. Detail drawings for all wear surface areas, perishable details, positioning details or generally details touching the part, shall be provided for all standard machines.
 5. All original machine, tooling, and gage drawings shall be identified by assigning the appropriate prefix, the Manufacturing Engineering Drawing Number, and followed by the Suffix (see table below). Prefix shall include Equipment Site Code and Folder Type in the File Name and Drawing Title Block.

Note: For sub-assembly, detail and standard purchased altered part drawings; the sheet number is the same as the detail number. Refer to detail number allocation, section 3.7.
 6. Revisions of the original folders shall retain the original site codes, even if the equipment has been relocated to a new site. The original site code shall be retained on revised and added sheets in the Drawing Title Block. New site locations should be documented in the Folder Drawing Parts List (DPL).
 7. The Engineer in Charge will supply the drawing number.
 8. The Engineer in Charge may specify the tooling is owned by a Nexteer Automotive customer and may require special tagging/markings. The engineer will provide the customer specific information that shall be included on the drawings and tooling.
 9. Refer to [Appendix A](#) for file naming convention examples.

Tooling Folder – Mechanical Design

FOLDER NAMING CONVENTION:
S(A)-(BB)123456-(drawing description)



FILE NAMING CONVENTION:
S(A)-(BB)123456-(CCC)-(DDD)-(EEE)

Key for (A) – Equipment Site Code

B – Brazil
D – Indonesia
E – Europe Tech Center
F – Wuhan
H – Suzhou
I – India
J – Juárez
M – Australia
N – Asia Tech Center (Nippon)
O – Chongqing
P – Prototype Center
Q – Querétaro
S – Saginaw
T – Tychy / Gliwice
U – Liuzhou
V – Morocco
W – Wuhu
Y – Lingyun
Z – Global Common

Historical Sites

A – Alabama
C – Cadiz
G – Strasbourg
K – New Castle
L – Livorno
R – Sabinas Hidalgo
X – Mexico Tech Center

Key for (BB) – Tooling Folder Type

AL – All alloy details used in any heat treating furnaces
DT – All die tooling
GA – All gages and test equipment to check production parts
TL – All other original designs
FX – All fixtures for engineering validation

Key for (CCC) – Sheet Type

ASM – Assembly drawings
SUB – Sub-assembly drawings
SPA – Standard purchased altered parts
CHT – Chart
DPL – Drawing parts list
DET – Detail
3DD – 3D Dimensional Math Data Model

(DDD) - Sheet Number

ASM – 001, 002, etc. (Sheet = ASM Number)
SUB – 501 → 599 (Sheet = SUB Detail Number)
SPA – 601 → 999 (Sheet = SPA Detail Number)
CHT – 001, 002, etc.
DPL – 000 (Excel drawing parts list)
DET – 001 → 499 (Sheet = DET Detail Number)
3DD – 001, 002, etc. (Sheet = Model Number)

(EEE) - Revision level

Example: 001, 002, ... 999
999 is the revision level indicating an obsolete sheet

2.2.3. Machine C Folder – Controls Drawings

1. All controls drawings shall be identified by assigning the appropriate prefix, the capital equipment or expense equipment number, followed by the suffix (see table below). Prefix shall include Equipment Site Code and Folder Type in the File Name and Drawing Title Block.
2. Revisions of the original folders shall retain the original Site codes, even if the equipment has been relocated to a new site. The original sight code shall be retained on revised and added sheets in the Drawing Title Block. New site locations should be documented in the Folder Drawing Parts List (DPL).
3. The Engineer in Charge will supply the equipment number for the drawings.
4. Refer to [Appendix A](#) for file naming convention examples.

Machine C Folder – Controls Drawings	
<p>FOLDER NAMING CONVENTION: S(A)-(BB)123456-C-(drawing description)</p>	<p>Key for (BB) – Machine M Folder Type SD – Capital Equipment FX – Validation Engineering M(A) – Non-capitalized Equipment MA – Alabama, USA MS – Saginaw, USA See Key for (A) for additional Site Codes</p>
<p>FILE NAMING CONVENTION: S(A)-(BB)123456-(CCC)-(DDD)-(EEE)</p>	<p>PE – Plant Engineering PL – Plant Layout PR – Process Equipment (Reprographics dispensed number)</p>
<p>Key for (A) – Equipment Site Code B – Brazil D – Indonesia E – Europe Tech Center F – Wuhan H – Suzhou I – India J – Juárez M – Australia N – Asia Tech Center (Nippon) O – Chongqing P – Prototype Center Q – Querétaro S – Saginaw T – Tychy / Gliwice U – Liuzhou V – Morocco W – Wuhu Y – Lingyun Z – Global Common</p>	<p>Key for (CCC) – Sheet Type ELE – Electrical diagrams HYD – Hydraulic diagrams PNU – Pneumatic diagrams LUB – Machine lubrication diagrams COL – Coolant / quench diagrams WAT – Water, gas, etc. diagrams DPL – Drawing parts list</p>
<p>Historical Sites A – Alabama C – Cadiz G – Strasbourg K – New Castle L – Livorno R – Sabinas Hidalgo X – Mexico Tech Center</p>	<p>(DDD) - Sheet number Example: 001, 002, 003 Where applicable, for Excel parts list, use DPL-000C for machine Control drawings (see section 5.2.1.).</p>
	<p>(EEE) - Revision level Example: 001, 002, ... 999 999 is the revision level indicating an obsolete sheet</p>

3. Drawing Standards

3.1. General Standards

- 3.1.1. Nexteer Automotive has an AutoCAD toolkit that **must** be used for machine, controls, assembly, sub-assembly and detail drawings provided to Nexteer Automotive. This toolkit is available on nexteerdtaexchange.com vendor documents website.

3.2. CAD System

All new drawings shall be created using one of the following Computer-Aided Design (CAD) software packages.

3.2.1. AutoCAD

1. AutoCAD files shall be saved in AutoCAD 2012 file format or earlier.
2. AutoCAD may be used for facilities, controls, tooling, and plant / machine layout drawings.
3. All drawings shall be created using the Manufacturing Engineering AutoCAD Standard – [Appendix C](#).

3.2.2. NX (formerly Unigraphics):

1. NX files shall be saved in NX7.5 format or NX9 when available.
2. NX may be used when designing tooling that contacts the part.
3. The NX 3D model for the tooling shall be provide as part of the documentation and is to include the .prt file(s) and .pdf file(s).
4. Additional files, e.g. ParaSolid .x_t file, required by the Engineer in Charge, shall be provided by the supplier.

3.2.3. Solid Edge:

1. Solid Edge files shall be saved in Solid Edge version 16.x.
2. Solid Edge may be used when designing machines and tooling.
3. Solid Edge has 4 types of files:
 - a. Assembly – .asm
 - b. Weldment – .pwd
 - c. Part – .par
 - d. Drawing – .dft
4. The Solid Edge model shall be provided as part of the documentation. In general, the model filenames should align with the assembly, sub-assembly and detail numbers.
Ex: SS-TL123456-3DD-000-001 – Assembly model
SS-TL123456-3DD-501-001 – Subassembly 501 model
SS-TL123456-3DD-001-001 – Part (Detail) 001model
5. For each assembly/sub-assembly (.asm), weldment (.pwd) and part (.par) the supplier shall provide a 2D detailed drawing (.dft). This file is to include Nexteer Automotives standard Title Block. The .dft is not required for purchased parts.
6. For each .dft file, the supplier shall convert it into an AutoCAD compatible file (i.e. .dwg or .dxf). If AutoCAD compatible files are not required, as specified in the Manufacturing Engineering Purchase Specification, the supplier is to provide .pdf files.
7. When AutoCAD compatible files are generated from a 3D model, the layer standards for color and line types are preferred, but not required.
8. Additional files, e.g. ParaSolid .x_t file, required by the Engineer in Charge, shall be provided by the supplier.

3.2.4 Solidworks:

1. Solidworks files shall be saved in version 2016
2. Solidworks may be used when designing machines and tooling.
3. Solidworks has 3 types of files:

- a. Assembly – .sldasm
- b. Part – .sldprt
- c. Drawing – .slddwg

4. The Solidworks model (component or assembly) shall be provided as part of the documentation. In general, the model filenames should align with the assembly, sub-assembly and detail numbers.

Ex: SS-TL123456-3DD-000-001 – Assembly model
SS-TL123456-3DD-501-001 – Subassembly 501 model
SS-TL123456-3DD-001-001 – Part (Detail) 001model

5. For each assembly/sub-assembly (.sldasm) or part (.sldprt), the supplier shall provide a 2D detailed drawing (.slddwg). This file is to include Nexteer's standard title block. A drawing is not required for standard purchased parts.
6. For each .slddwg file, the supplier shall convert it into an AutoCAD compatible file (i.e. .dwg or .dxf). If AutoCAD compatible files are not required, as specified in the Manufacturing Engineering Purchase Specification, the supplier is to provide .pdf files.
7. When AutoCAD compatible files are generated from a 3D model, the layer standards for color and line types are preferred, but not required.
8. Additional files, e.g. ParaSolid .x_t file, required by the Engineer in Charge, shall be provided by the supplier.

3.2.4. Other 3D CAD Packages

1. The requirements outlined above in the Solid Edge/Solidworks shall be followed.
2. The solid model(s) shall be provided.
3. 2D drawings shall be provided as AutoCAD compatible files.

3.3. Existing Non-electronic Drawings

- 3.3.1. For instructions on working with existing non-electronic drawings reference [Appendix D](#).

3.4. Language

- 3.4.1. All drawings purchased by Nexteer Automotive shall be in English. The Engineer in Charge or the receiving plant may request the addition of native language translations for all text on the drawing.


3.5. Sheet Size

- 3.5.1. The toolkit provides standard drawing sizes in both North American and Metric standard sheet sizes, appropriate for the original destination of the piece of equipment. The designer shall select the smallest standard sheet size to draw the details in full scale, or that provides a clear image of the detail or assembly with a clearly defined scale factor. Refer to [Appendix B](#) for an example of North American D-size and Metric A1 including title and revision blocks.

3.6. Title/Revision Block & Sheet Identification Information for all Drawings

- 3.6.1. Nexteer Automotive will not accept drawings with a PROPRIETARY statement on them.
- 3.6.2. Machine M Folder drawings may be acceptable with supplier title block and Nexteer Automotive equipment number added in the lower right-hand corner, if approved by Engineer in Charge.
- 3.6.3. Refer to Figure 1, for clarification of the following title block instructions. The circled numbers in Figure 1 correspond with the item numbers below.

Figure 1

<p>STAMP OR ETCH ON ALL DETAILS THE DRAWING AND DETAIL NUMBER, AND THE LATEST APPLICABLE REVISION SYMBOL. IF ROOM PERMITS, STAMP OR ETCH THE VENDORS INITIALS AND DATE OF MANUFACTURE. DO NOT SCALE DRAWING 2 PLACE DECIMALS ±.01 INCHES 3 PLACE DECIMALS ±.005 INCHES 4 PLACE DECIMALS ±.0005 INCHES ANGLES ±0°30' REMOVE ALL SHARP EDGES</p>			
 <p>THIS DOCUMENT IS PROTECTED BY COPYRIGHT AND NOTHING IN THIS DOCUMENT SHALL GRANT A LICENSE OR ANY OTHER RIGHTS TO THIS DOCUMENT OR THE INFORMATION CONVEYED THEREIN: THE REPRODUCTION, DISTRIBUTION, AND UTILIZATION OF THIS DOCUMENT OR ITS RELATED CAD MATH DATA, AS WELL AS COMMUNICATION OF ANY CONTENT TO OTHERS, WITHOUT THE EXPRESS WRITTEN AUTHORIZATION IS PROHIBITED.</p>			
(3)		(2)	
PART NO.		PART NO.	
		DESIGN APPROVED (4)	DRAWN BY (7)
		CHECKED BY (5)	SCALE (8)
		DATE (6)	DATE (9)
<p>PREFIX – DRAWING NUMBER – SHEET TYPE – SHEET NUMBER</p> <p>(1)</p>			

(10)
Supplier Name and Job#

1. Sheet Prefix – Drawing Number – Sheet Type – Sheet Number:
 - a. Sheet Prefix as defined in section 2.2. Prefix shall include Site Code and File Type.
Note: The hyphen between the Folder Type and the Drawing Number is optional.
 - b. Drawing Number as provided by the Engineer in Charge
 - c. Sheet Type as defined in 2.2
 - d. Sheet Number of the sheet

Ex: SS-TL123456-ASM-001 or SS-TL-123456-ASM-001
 SS-TL123456-SUB-501 or SS-TL-123456-SUB-501
 SS-TL123456-DET-001 or SS-TL-123456-DET-001
 SS-SD123456-MCH-001 or SS-SD-123456-MCH-001
2. Sheet description, the name of the assembly, subassembly, or detail and its function shall be provided.
3. Part number(s) of the product(s) being processed. Enter on the first assembly sheet only. Sheets showing sub-assemblies used in the processing of certain product(s) shall show only the part number(s) applicable to that sub-assembly.
4. The initials of the Nexteer Automotive manufacturing engineer shall be entered on sheet 1 only, when a design is approved for detailing.
5. The initials of the checker shall be entered.
6. The date the drawing was checked shall be entered.
7. The initials of the designer shall be entered.
8. The scale of the drawing shall be indicated.
9. The date the drawing was completed shall be entered.

10. All sheets drawn by persons other than Nexteer Automotive personnel shall have the supplier's name and job number shown outside the right vertical border on all sheets.

3.6.4. Refer to Figure 2, for clarification of the following revision block instructions. The circled numbers in Figure 2 correspond with the item numbers below.

Figure 2

REVISIONS						MF
REV. SYM.	DET.	CHANGE	BY	CK	DATE	
①		②				

1. Sheet revisions shall be three character numeric with the initial version "001".
2. For new sheets the change is "Original" or "As Released".
3. For further detail refer to the Mechanical Drawing Revisions in section 4.5 and Control Drawing Revisions in section 5.3.

3.7. Detail Number Allocation

3.7.1. All details and components on the drawings shall be assigned a unique detail number. The detail numbers shall be assigned sequentially by categories as follows:

<u>Detail No.</u>	<u>Usage</u>	<u>Part List Sheet Type</u>
1-499	All mechanical and call-back details	M
500-599	All subassemblies	A
600-999	Purchased standard and altered standard details	S
1000-1099	All electrical components shown on machine layouts	E
1100-1199	All electrical components shown on controls layouts	E
2000-2099	All pneumatic components shown on machine layouts	P
2100-2499	All pneumatic components shown on controls layouts	P
2500-2599	All hydraulic components on the machine layouts	H
2600-2999	All hydraulic components shown on controls layouts	H
3000-3099	All lubrication components on the machine layouts	L
3100-3299	All lubrication components shown on controls layouts	L
3300-3399	All water components on the machine layouts	W
3400-3599	All water components shown on controls layouts	W
3600-3699	All coolant components on the machine layouts	C
3700-3899	All coolant components shown on controls layouts	C

4. Mechanical Drawing Standards

4.1. General Standards

- 4.1.1. The space between the revision block and the title block shall not be used for any reason except to extend the revision block.
- 4.1.2. All CAD drawings shall be created full scale. Title block should be scaled to plot full size on preferred paper size (i.e. D or metric A1). Minimum text height is .125 inches or 3 mm.

- 4.1.3. All drawings shall be legible as a B size (metric A3) print.
- 4.1.4. Drawings to be illustrated in either third angle projection or first angle projection and shall be clearly designated with the respective legend shown in figure 3.

Figure 3

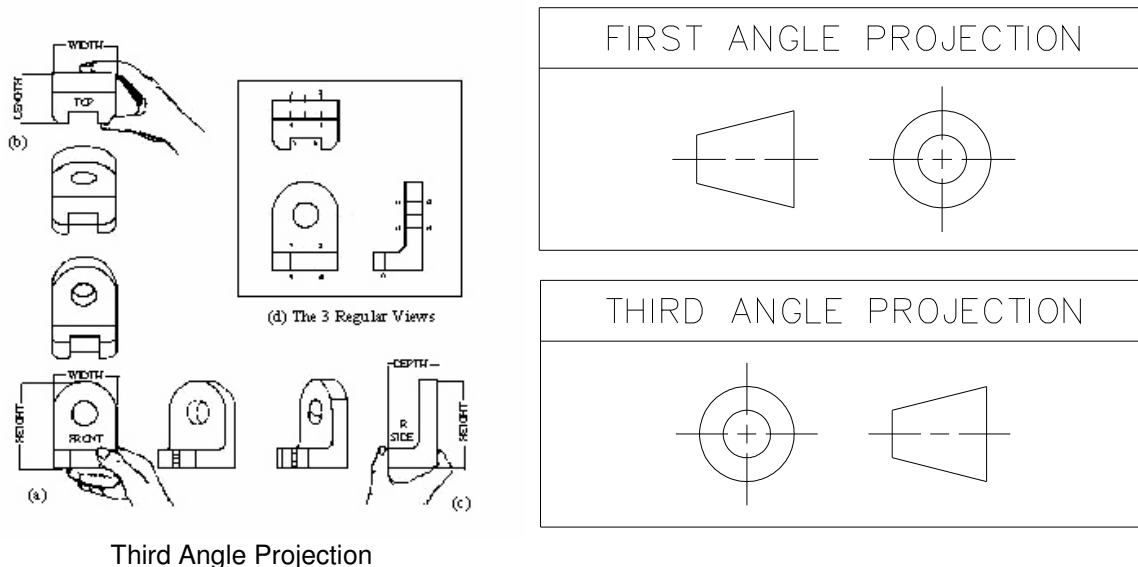


Illustration taken from Technical Drawing, 7th Edition: Giesecke, Mitchell, Spencer, Hill, Dygdon (MacMillan Publishing Co., New York, 1985)

- 4.1.5. All dimensions and notes on the drawings shall be shown horizontally, to be read from the bottom of the sheet.
- 4.2. Assembly (General Machine and Fixture Layout Standards for all Drawings)
 - 4.2.1. The product being tooled shall be shown in phantom lines in sufficient views to verify clearances with the tooling and fixture during the load, unload, and machine or station cycle. Additional parts shall be shown in different phantom lines using different colors.
 - 4.2.2. Mechanisms or components that are intended to move, either cyclically or by adjustment, shall be shown in both extremes of travel to verify that the design fulfills its intended functions while allowing sufficient clearance.
 - 4.2.3. Significant electrical, hydraulic, pneumatic, lubrication, coolant and water components (e.g., motors, limit switches, cylinders, palm buttons, operator control consoles, etc.) which require placement in a specific location to fulfill their intended function, shall be shown on the layout.
 - 4.2.4. Machine and/or fixture mounted control components (electrical, hydraulic, pneumatic, lubrication, coolant and water) shall be shown on the appropriate machine or tool drawings. These components shall be called out on their respective drawing parts list.
 - 4.2.5. Machine guards do not require drawings.

4.3. General Tooling Layout Standards

- 4.3.1. All tool layouts shall be drawn full scale on D size (metric A1) sheets. Exceptions must be approved by the Engineer in Charge.
- 4.3.2. The tool layout and all details shown as part of the tool layout shall be assigned the same drawing number. A separate tool layout shall be drawn for each working station of a transfer machine and assigned a separate drawing number. A single tool layout shall be drawn for all automatic screw machines, dial index machines, multiple spindle drill presses, special machines, and trunnion type machines.
- 4.3.3. Tool layouts shall show machine/station appropriate tooling, set-up dimensions, and other data such as speeds, feeds, gears, cams, tool paths, strokes, dwells, and all other necessary information to re-set-up to original conditions.

4.4. General Detailing Standards

- 4.4.1. Detail drawings shall have only one detail per sheet.
- 4.4.2. No detailing shall appear on the assembly drawing.
- 4.4.3. Detailed drawings shall be provided for any machine components that are not stock items by the machine or other suppliers.
- 4.4.4. Each detail drawing shall have:
 - 1. The detail number
 - 2. Name
 - 3. Quantity
 - 4. Material spec.
 - 5. Heat Treatment (hardness) requirements shall be shown directly under each detail.
 - 6. Scale (If not full scale) as provided by the Nexteer Automotive Toolkit.
- 4.4.5. All details and subassemblies used as call-back* shall have the following note shown directly to the left of the detail number balloon or in as near proximity as feasible. "This detail used on other drawing numbers." In addition, below this note, add the tool and detail number on which it is used.
 - * Call-backs are manufactured details from a previously built machine. Call-backs should be used where feasible to reduce records storage and spare part inventory.
- 4.4.6. Generally, Nexteer Automotive's steel selection for fixtures and machine components will fall into five categories based on strength and hardness requirements.
 - 1. Low strength and no hardness:
 - a. SAE 1018 H.R.S., SAE 1020 H.R.S. for ordinary weldments.
 - b. SAE 1018 C.R.S. for ordinary machine and fixture details. (Use stock sizes to eliminate machine operations.)
 - c. SAE 1018 and 1020 H.R.S. and boiler plates for large details and plates.
 - 2. Strength and medium hardness special application.
 - a. SAE 4150 pre-hardened R/C 28-34
 - 3. Hardness and strength:
 - a. Thru hardening steels selected for their particular application, SAE 4150, 6150 for general use. Die steels, drill rod, gage stock, etc. for special application.
 - b. These steels can be thru hardened or localized or case hardened with minimum distortion.

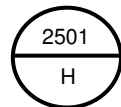
4. Hardness and low strength:
 - a. Use items b and c as first choice.
 - b. SAE 1018, 1020, and 8620 steels to be carburized (this is the last choice and is for use only where items listed above are not acceptable).
 - c. Carbonitride hardening to be used for special application only.
 5. Specialty steels:
 - a. The use of these is recommended where they meet the requirements of a particular application and reduce the machining and heat treat costs. These are: Thomson 60 case shafting; Maxel, various forms of key stock, fatigue proof and stress proof shapes, and Turned, Ground and Polished (T.G. & P.) shafting.
- 4.4.7. When special steels or treatments are specified, give:
1. Name of company
 2. Location in parenthesis All heat treat notes which require or imply case hardening, i.e., carburize and harden, induction or flame harden, should specify case depth and where core hardness is important: specify core hardness.
- 4.4.8. All low carbon steel weldments should be stress relieved at 1000 Deg. F., or higher, before finish machining. All high carbon steel weldments should be normalized at 1650 Deg. F., or higher, before finish machining, and so noted on the drawing.
- 4.4.9. All undercuts and relief's shall be shown and dimensioned completely.
- 4.4.10. On shafts and other round parts, show optional centers permissible for processing. If detrimental to part function, then specify no centers permissible.
- 4.4.11. Welded, brazed, or silver soldered details fabricated of two or more parts shall be identified as one manufactured detail. The various parts, if made of structural items etc., will be identified to standard manufacturer's identification: e.g., angle iron, channel, etc.
- 4.4.12. Finish symbols ✓ shall be used to indicate a machined surface on a weldment or casting only.
- 4.4.13. Surface texture symbols ✓ shall be used as required, to specify surfaces where texture is a functional requirement.
- 4.4.14. Dovetail type form tools shall have a note on the detail drawing to mark the drawing number, detail number, and revision symbol on the back of the detail.
- 4.4.15. All standard and purchased details that must be altered in any way shall be drawn on a detail sheet and given the appropriate purchase detail number. Only the alteration required and any reference dimensions that are necessary shall be shown.
- 4.4.16. All subassemblies (500 series details) shall be drawn on a separate sheet as a detail and shall be assigned a subassembly detail number. Each detail of the subassembly shall then be assigned a separate detail number and be detailed as on any other assembly.
- 4.4.17. Detail number balloons on assembly, subassembly, and detail drawings, must be 0.62 inch (16 mm) diameter. The detail number must be shown in the top half of the balloon and the sheet number of the detail must appear in the bottom half. For call back and purchase details, description may be added to the leader line. Detail drawings shall reference the assembly or sub-assembly sheet as the bottom number of the balloon.
- 4.5. Drawing Parts List
1. The Nexteer Automotive Excel Drawing Parts List (DPL) template (form DS2518) is available on nexteerdatabase.com vendor documents website.
- 4.5.1. All Machine M Folders (design owned by Nexteer Automotive) and Tool Folders shall use the DPL Template. Field entries are defined in sections 4.5.4 and 4.5.5. The parts list header and revision information is entered on the revision sheet as described in sections 4.5.4 and 4.5.5.

Note: When updating existing drawings, revise the existing parts list or convert the entire parts list to the Excel drawing parts list.

- 4.5.2. For Machine M Folder drawings, suppliers parts lists may be acceptable, if approved by the Engineer in Charge. Parts lists must contain, as a minimum, information detailed in 4.5.5. item 10 for all perishable details.
- 4.5.3. Machine mounted control devices, such as limit switches, proximity switches, 3 phase motors, hydraulic and pneumatic cylinders, etc., shall be shown on assembly drawings with the detail description and included on the appropriate mechanical parts list. Such devices shall not be duplicated on the controls parts list.

Exception: Servo control devices, along with their electrical controls, shall be placed on the electrical parts lists and referenced on the mechanical drawings, since typically such systems are integrated packages.

Example detail number for a hydraulic cylinder on the Machine M Folder or Tool Folder drawing:



The detail description for 2501 is on the Excel parts list, SD-123456-DPL-000M or TL-123456-DPL-000, sheet type H.

Figure 4

MANUFACTURING ENGINEERING DRAWING PARTS LIST REVISION SHEET			
1 PREFIX DT	2 DRAWING NUMBER 123456	3 TYPE REV	4 DRAWING DESCRIPTION TRANSFER FINGERS
5 REV SYM A	6 REVISED 1-Jan-03	7 VENDOR INFORMATION D&D DESIGN JOB #180	
8 REVISION DESCRIPTION AND RELATED DETAIL / SHEET NUMBERS ORIGINAL			
		9 VENDOR D&D	10 DRAWN BY ME
		11 CADD BY YOU	12 DATE 1-Jan-03

- 4.5.4. Refer to Figure 4, Drawing Parts List Revision Sheet in this section, for clarification of the following instructions. The numbers in Figure 4 correspond with the item number below.
1. The drawing "Prefixes" entries are defined in Section 2.2.
 2. The "Drawing Number" entries are defined in Section 2.2.
 3. The drawing "Type" entries are defined in Section 2.2. Each type requires a unique sheet.
 4. The "Drawing Description" box must be a concise description of the design.
 5. The "Rev Sym" will be a three-character numeric. The revision numeric will increment one each time that the drawings are submitted. See section 2.2 (FFF) for examples.
 6. The "Revised" date entry corresponds to the latest sheet revision. This along with the "Rev Sym" must be updated at submission.
 7. The "Vendor Information" entry consist of the vendors name and job tracking numbers.
 8. The "REVISION DESCRIPTION AND RELATED DETAIL / SHEET NUMBERS" entry consists of a concise description of the types of revisions that were made.
 9. The "VENDOR" entry consists of a concise identification of the original vendor.

10. The "DRAW BY" entry consists of a 2 or 3 character identification of the drafts person.
11. The "CKD BY" entry consists of a 2 or 3 character identification of the checker.
12. The "DATE" entry must correspond with the "REVISED" date.

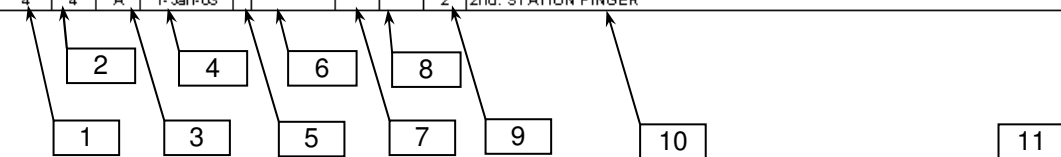
Figure 5

MANUFACTURING ENGINEERING
DRAWING PARTS LIST

PREFIX	DRAWING NUMBER	TYPE	DRAWING DESCRIPTION						
DT	123456	M	TRANSFER FINGERS						

REV SYM	REVISED	VENDOR INFORMATION							
A	1-Jan-03	D&D DESIGN JOB #180							

DETAIL No.	SHEET No.	REV SYM	REV DATE	ST	CALLBACK Dwg No.	CB DET No.	CB SHT No.	NUM REQD	DETAIL DESCRIPTION	REF SHT No.
1	3	A	1-Jan-03					2	1st. STATION FINGER	1
2				C	654321	1	2	4		1
3				C	654321	2	3	4		1
4	4	A	1-Jan-03					2	2nd. STATION FINGER	2



4.5.5. Refer to Figure 5, Drawing Parts List, in this section, for clarification of the following instructions. The numbers in Figure 4 correspond with the item number below.

1. The "Detail Number" entry consists of the appropriate detail number as shown in 3.6.
2. The "Sheet Number" entry consists of the drawing sheet numbers of the assemblies, sub assemblies, and detail sheets within this drawing number.
3. The "Rev Sym" entry consists of the drawing sheet revision symbol of the assemblies, sub assemblies, and detail sheets within this drawing number.
4. The "Rev Date" entry consists of the drawing sheet revision date of the assemblies, sub assemblies, and detail sheets within this drawing number.
5. The "ST" (Status) entry consists of one of the following:
 - a. This entry is blank for active sheets in the drawing number.
 - b. The "C" entry is required for all callback details and sheets.
 - c. The "O" entry is required for all obsolete sheets.
 - d. The "O" entry is required for all obsolete callbacks, "C" entry is replaced.
6. The "Callback Dwg Num" entry consists of the drawing number of the original detail. Note that this also applies to subassemblies.
7. The "CB DET" entry consists of the detail number of the original callback detail. Note that this also applies to subassemblies.
8. The "CB SHT" entry consists of the sheet number of the original callback detail. Note that this also applies to subassemblies.
9. The "NUM REQD" entry consists of the total detail quantities required to build this drawing number.
10. The "DRAWING DESCRIPTION" entry consists of a concise description of manufactured details.

Purchased component descriptions will be given the following sequence:

- a. Manufacturer's Name,
- b. Part Name,
- c. Model Number,
- d. Additional Description that is required.
- e. Standard tooling, such as drills, reamers, taps, carbide inserts, grinding wheels, etc. must be described completely without using a Nexteer Automotive number or Manufacturer's name and catalog number unless absolutely necessary. Standard drill bushings must be identified by the A.N.S.I. number.
- f. Alter - must be the first word in the detail description of any altered standard, purchased detail.

11. The "ref sht no" entry consists of the assembly or subassembly sheet number where this detail call out first appears.

4.6. Dimensioning

- 4.6.1. Metric dimensioning is standard for all locations. Inch dimensioning is allowed in North America. If inch dimensioning is used, then metric dimensions should also be included.
- 4.6.2. Flatness, squareness, straightness, centrality and parallelism will be spelled out in descriptive language. Geometric tolerancing may be used.
- 4.6.3. All holes must be described as dimensioned diameters or as a thread. The terms drill, ream, C'bore, taper, etc. should not be used.
- 4.6.4. Reference dimensions must be the mean figure, two, three, or four place decimal as required, and must not have a tolerance given (EX: 1.276 Ref. or 1.3755 Ref.).
- 4.6.5. Roll pin hole diameter tolerance shall be nominal plus 2% of nominal / minus 0.00 .
- 4.6.6. Tolerances on dimensions which locate mating roll pin holes must be +/- .001 inches (.03 mm).
- 4.6.7. Tolerances on keys and keyways must be determined according to function. All noncommercial keys must be detailed.
- 4.6.8. Keys and keyways that will carry reversing or varying loads, or that must maintain an accurate location, shall be dimensioned for a press fit. Refer to American National Standard Keys and Keyways (ANSI B94.19-1985).
- 4.6.9. Keys and keyways for cylindrical parts must be noted "to be central within specific total indicator reading."
- 4.6.10. "Locate at Assembly" note must specify what features to locate to in these instances. The assembly drawing must have notes and/or dimensions specifying completely the location including concentricity, parallelism and squareness requirements. The removable detail must be dimensioned completely.
- 4.6.11. Standard dowel pin hole diameters (inches) must be dimensioned as follows:

<u>HOLE DIA.</u>	<u>TOL.</u>	<u>HOLE DIA.</u>	<u>TOL.</u>
<u>PRESS FIT</u>		<u>SLIP FIT</u>	
Nominal	+.0001	Nominal	+.0008
	-.0003		+.0004

These inch-standard measurement tolerances may be converted to metric-standard measurements.

- 4.6.12. Tolerance on dimensions which locate mating dowel hole locations must be +/- .0005 inches (.013 mm) maximum.
- 4.6.13. Tolerance on dimensions which locate threaded holes and screw clearance holes must be +/- .005 inches (.13 mm).

-
- 4.6.14. Bolt circle dimensioning must not be used.
 - 4.6.15. Bearing shaft, housing and shoulder dimensions must be in accordance with Annular Bearing Engineers Committee (ABEC) recommendations.
 - 4.6.16. Critical angular surfaces must be dimensioned from a construction hole or tooling ball, or measured over standard size rolls or balls as required.
 - 4.6.17. Threaded holes must be described by specifying the nominal thread size, number of threads per inch, (example: 1/4-28 thread). All threads must be American National Standard Class 2B fits (ANSI B94.9-1979).
 - 4.6.18. Press fit bushings and bushing liners must be dimensioned according to American National Standard Class FN1 fits (ANSI).
 - 4.6.19. When blind dowel pin holes are unavoidable, pull type dowel pins must be used.
 - 4.7. Mechanical Drawing Revisions
 - 4.7.1. General rules for drawing revisions:
 - 1. Sheet revisions shall be three character numeric from 001-998.
 - 2. New sheets shall be "001".
 - 3. Sheet revisions shall increment by one number each time (Ex: 002, 003, ... 998).
 - 4. Obsolete sheets shall have the revision "999".
 - 5. If the previous sheet revision is alphabetic ("A", "B", etc.) use "101" as the next revision
 - 4.7.2. All revisions made to a drawing, including those of a bookkeeping nature, must be assigned a numeric revision.
 - 4.7.3. The detail number or special sheet name must be given in the change description column along with the revision description when making revisions to the older drawings that have no detail number in the revision block.
 - 4.7.4. All sheets of a drawing that are revised at one time must have the same date shown in the revision block.
 - 4.7.5. All revision symbols on the drawing must be shown horizontally in a .25 inch maximum inscribed circle triangle adjacent to the revision(s).
 - 4.7.6. A revision requiring the revision symbol to appear in two or more places on a sheet must show, in the lower right portion of the revision block, revision symbol space, the number of times the revision appears on the sheet (e.g., 001s).
 - 4.7.7. All revisions must have the initials of the designer and checker shown in the revision block.
 - 4.7.8. Care must be taken when redrawing existing details, with or without revisions, on all Manufacturing Engineering Department drawings as follows:
 - 1. For sheets that have one detail and it is being revised and redrawn:
 - a. The redrawn sheet must have the next numeric revision, after the last one used on the original sheet, shown on the new sheet. The description "detail revised and redrawn" must be shown in the revision block.
 - 2. For sheets with multiple details and one detail is being revised and redrawn:
 - a. A detail redrawn on a new sheet must have the next numeric revision, after the last applicable revision used on the original sheet. The description "detail revised and redrawn from sheet_____" must be shown in the revision block.
 - b. The original sheet must have the detail crossed out on the face of the tracing. A bookkeeping description "detail revised and redrawn on sheet_____" and the next revision must be shown in the revision block.
 - c. A bookkeeping revision must be made on the assembly drawing and Drawing Parts List to correct the detail sheet number.

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- 4.7.9. A new detail added to a drawing must be drawn on a new sheet. The bookkeeping description "sheet and detail added" must be shown in the revision block.
- 4.7.10. New sheets added to a drawing must not be inserted in place of any previously obsoleted sheets, but must be added to the total number of sheets.
- 4.7.11. When replacing a manufactured detail with a call-back detail, the bookkeeping revisions must be recorded as follows:
1. The description "was detailed on this sheet" must be shown in the revision block of the detail sheet.
 2. The description "was on sheet no. _____" must be shown in the revision block of the assembly sheet and Drawing Parts List.
- 4.7.12. When replacing a call-back detail with a manufactured detail, the bookkeeping revisions must be recorded as follows:
1. The description "was call-back on sheet no. _____" must be shown in the revision block of the detail sheet.
 2. The description "was on P/L" must be shown in the revision block of the assembly sheet.
 3. The description "was (Dwg. No.) detail _____" must be shown in the revision block of the Drawing Parts List.
- 4.7.13. The revisions on all sheets must begin with "001", except on the sheets with details that have been redrawn (see 4.7.8 and 4.7.9) and proceed through "998" as required.
- 4.7.14. All revisions made on the assembly drawings must be drawn to scale. It is permissible for the detail drawings to be out of scale, but a wavy line must be put under any dimension that is out of scale more than .06 inches.
- 4.7.15. The revisions on all details must be itemized in the revision block if the detail can be reworked.
- 4.7.16. When a detail is "obsoleted", the following must be crossed out on the sheet:
1. Drawing Description
 2. Balloon
 3. Listing In The Detail Column
 4. Detail Number on the Assembly Drawing
 5. Drawing Parts List
- These numbers will be noted as a bookkeeping revision and the description of the "detail obsoleted" shall be shown in the revision block of all affected sheets.
- 4.7.17. When a sheet of a drawing is obsoleted, a note must be added to sheet one in the general area of the title block, listing the obsolete sheet numbers(s), since the total number of sheets must remain the same.
- 4.7.18. When a complete drawing number is obsoleted, a notation shall be added in large letters in the lower right portion of every sheet and the revision "999" must be shown in the revision block. This notation must include the date and initials of the designer and checker, and on sheet one only must also include the request number and/or reason for obsoleting the drawing number.
- 4.7.19. When an obsolete detail is reinstated to active status, it must be redrawn on a new sheet:
1. The redrawn sheet must have the last revision, prior to it being obsoleted. The description "detail reinstated and redrawn from sheet _____" must be shown in the revision block.
 2. The original sheet with the obsoleted detail is to remain as is.
 3. A bookkeeping revision with the description "detail reinstated" and the corrected sheet number must be made on the assembly drawing and Drawing Parts List.

- 4.7.20. Procedure for obsoleting a detail on Parts List:
1. On the face of the sheet, draw a line through the Detail Number, Sheet Number, required, and detail description.
 2. Fill in Revision Block.

- 4.7.21. If a folder is obsoleted, for a non-electronic folder, the original drawings will be destroyed and a microfilm copy will be kept for record only. For electronic folders, the obsolete drawings, updated per 4.7.18, will remain in the system.

4.8. Experimental Details

- 4.8.1. Each experimental detail must be drawn on a separate sheet and assigned a new detail number.
- 4.8.2. The word "EXPERIMENTAL" must be printed adjacent to the detail number balloon above the detail specification.
- 4.8.3. On the assembly drawing, the experimental detail number balloon must be placed adjacent to the detail number balloon of the detail that may be replaced, with "EXP" printed adjacent to the balloon.
- 4.8.4. The experimental detail must be entered on the Parts List and identified as "EXPERIMENTAL".
- 4.8.5. Should the experimental detail prove to be effective, bookkeeping revisions must be made on the assembly drawing, the detail drawing and the Parts List to remove the "EXPERIMENTAL" references. The detail being replaced must be obsoleted on the assembly drawing, the detail drawing and the parts list with appropriate bookkeeping revisions.
- 4.8.6. Should the experimental detail prove to be undesirable, it must be obsoleted on the assembly drawing, the detail drawing and the parts list with appropriate bookkeeping revisions.

5. Controls Drawing Standards

5.1. Drawing Requirements

- 5.1.1. AutoCAD drawings are required.
- 5.1.2. The complete documentation shall include only one drawing sheet per .DWG file.
- 5.1.3. All drawings shall be legible as a B size (metric A3) print.
- 5.1.4. Shape files shall not be used.
- 5.1.5. All drawings shall have Nexteer Automotive's title block.
- 5.1.6. Title block information shall be consistent with section 3.6.3.
- 5.1.7. Revision block information shall be consistent with section 3.6.4.
- 5.1.8. Functional characteristics, not evident from the control device symbol, are required. These characteristics include, but are not limited to:
1. Proper settings for user programmable/adjustable devices (e.g., dip switches, jumpers, rotary switches, pressure switches and flow switches) clearly indicated on the drawings
 2. Coils or contacts connected to their respective terminals for subassembly schematics not shown in the drawings
 3. Motor information such as horsepower, frame size, full load amperage, and speed clearly indicated on the drawings adjacent to its symbol. Include the appropriate frequency rating if the motor is not rated for 50/60 hz operation
- 5.1.9. All notes on the drawings shall be shown horizontally, to be read from the bottom of the sheet.

5.2. Drawing Parts List

- 5.2.1. Controls parts lists shall be grouped by category (electrical, hydraulic, pneumatic, etc.) and assigned detail numbers as defined in 3.7.1. Parts list on a separate D size sheet in the respective drawing set are preferred.

When it is necessary to use the Excel DPL template, the drawing folder sheet number shall be 000 and included in the machine C folder. Reference section 4.5 for data entry into the DPL template.

- 5.2.2. Purchased component descriptions will be given the following sequence:
1. Manufacturer's Name,
 2. Part Name,
 3. Model Number,
 4. Additional Description that is required
- 5.2.3. Detail number balloons on layout drawings, should be 0.62 inch (16 mm) diameter.
- 5.2.4. Machine mounted control devices such as limit switches, proximity switches, 3 phase motors, servo control devices, hydraulic and pneumatic cylinders, etc., shall be shown on assembly drawings with the detail description and included on the controls parts list.
- 5.2.5. Servo control devices, along with their electrical controls, shall be placed on the electrical parts lists and referenced on the mechanical drawings, since typically such systems are integrated packages.
- 5.2.6. Components such as limit switches, proximity switches, etc shall be shown on tooling drawings when they are part of the fixture/tooling that moves from machine to machine in addition to being included on the respective controls drawing and parts list.

5.3. Control Drawing Revisions

5.3.1. General rules for drawing revisions:

1. Sheet revisions shall be three character numeric from 001-998.
2. New sheets shall be "001".
3. Sheet revisions shall increment by one number each time (Ex: 002, 003, ... 998).
4. If the previous sheet revision is alphabetic ("A", "B", etc.) use "101" as the next revision

5.3.2. Revision 999 is reserved for sheets that have been obsoleted. Control drawing sheets will be replaced per this section and **not** obsoleted.

5.3.3. All sheets of a drawing that are revised at one time should have the same date shown in the revision block.

5.3.4. New drawing sheet numbers introduced as part of the machine revision shall contain the words "As Released" and use revision "001" in the Revision Block.

5.3.5. All revisions shall have the initials of the designer and checker shown in the revision block.

5.3.6. All reused drawing sheet numbers of a sheet type shall contain the words "Revised and Redrawn" and the next applicable numeric revision in the Revision Block.

5.3.7. All numbered sheets of a given type that are no longer used in the revised machine design shall be replaced with a blank drawing sheet created with the text "Spare Sheet" in large letters in the middle of the sheet. The Revision Block shall contain the words "Revised and Redrawn" and the next applicable numeric revision.

5.3.8. New drawing sheet numbers introduced as part of the machine revision shall contain the words "Revised and Redrawn" and use revision "001" in the Revision Block.

6. Operation and Service Manuals

6.1. Requirements

One operation and service manual for the machine and accessories shall be supplied at the time of shipment of the machine (a three ring binder is preferred with dividers to define the sections). The equipment supplier shall create the manual in Microsoft Word and provide an electronic file with all of the operation and service information. For any unique purchased components which are part of the machine (refer to section 6.7), the supplier shall provide a PDF file(s). In addition, the supplier should create a single PDF file from the Word document and insert the component PDF pages. Refer to [Appendix A](#) for operation and service manual file naming convention.

6.2. Language Requirements:

6.2.1. All documentation shall be provided in English. When equipment is purchased for a single global site, documentation in the country of destination is acceptable and supplier shall quote English documentation as an option.

6.2.2. If an electronic copy is available in the native language of the machine builder, this should be provided.

6.2.3. In addition, the following portions of the manual which are used by the operators shall be translated into the language of the country of destination. This portion shall be provided in an electronic file for translation by Nexteer Automotive.

1. Safety system information (6.5.2)
2. Machine Start-up procedure (6.5.10)
3. Machine Shut-down procedure (6.5.12)
4. Cycle operation & cycle start instructions (6.5.14)
5. Fault code directory & reset instructions (6.5.15)

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- 6.3. Title page - should include:
1. Machine name, serial number and operation name
 2. Applicable machine and control drawing numbers
 3. Manufacturer's name, address, phone number, project engineer and job number.
 4. Nexteer Automotive purchase order number
 5. Issue date of the manual
 6. List of Nexteer Automotive personnel involved (Manufacturing, Plant, and Controls Engineer)
- 6.4. Table of contents
- 6.5. Main body of manual in tabulated sections.
- A separate tab shall be provided for each station if the machine has multiple stations or operations. The station or drawing number shall be identified
- 6.5.1. Introduction, specific description of the equipment, process, capacity, etc.
- 6.5.2. Safety system information, including listing of all safety devices on the machine and instructions on how to operate, reset and verify correct operation
- 6.5.3. Receiving, handling, and storing instructions
- 6.5.4. Reduced copies of each assembly sheet folded to fit in an 8-1/2 x 11 inch or A4 binder, including machine parts lists. The electronic file does not require copies of drawings.
- 6.5.5. Schematic drawing of machine showing the location of limit switches, solenoid valves, motors, lubrication points, and all areas needing special attention.
- 6.5.6. Recommended spare parts list shall contain:
1. Part name and detail number
 2. Drawing number on which part appears
 3. Quantity of parts used
 4. Part manufacturer, model number, and capacity
 5. Recommended number of parts to be stocked
- 6.5.7. Utility requirements (utility information to be consistent with the "Utility" section of SD-001, Appendix C)
- 6.5.8. Installation instructions:
1. Alignment information to be included if required
- 6.5.9. Preparations for operation, including interlocks
- 6.5.10. Machine start-up procedure
- 6.5.11. Calibration procedure, to include special tooling information if required
1. Transducers
 2. Load Cells
 3. LVDT's, etc.
- 6.5.12. Machine shut-down procedure
- 6.5.13. Manual cycle description
- 6.5.14. Automatic cycle sequence of operation and cycle start instructions
- 6.5.15. Fault code directory, cause and reset procedure
- 6.5.16. Preventative maintenance instructions:

1. The instructions shall identify all maintenance activities required, including frequency to be performed and instructions on how to perform if required
2. Lubrication requirements shall include frequency, amount, and type of lubricant
3. Any frequent tasks to be performed by operations (such as daily cleaning tasks) shall be listed separately from longer term maintenance requirements

6.5.17. Trouble Shooting Guide

6.6. Operational Data.

The operation instructions must be in a logical order. Whenever cross references are used, the subtitle and page number must be stated.

6.6.1. Equipment and Process Settings:

1. Table or electronic file of any drive or servomotor settings and calibrations
2. All flow meter readings
3. Heat control setting
4. All timer settings
5. All pressure and pressure-switch settings
6. Speeds or time for all motions
7. Ampere readings for all motors
8. Water-control settings

Note: If any of these settings change based on part number, create a table with the setting for each part number.

6.6.2. Adjustment information for:

1. Slides
2. Gibs
3. Stops
4. All daily or periodic service or adjustments required

6.6.3. Pertinent information for standard components requiring special attention (Instrumentation setup etc.)

6.7. Booklets from component suppliers.

For standard catalog components that are not on the SD-007, Approved Components List, all documentation and service information shall be provided with the manual as electronic files. These documents may be downloaded from the supplier's website or scanned in pdf format from a paper copy. Include a list of these standard catalog component manufacturers/suppliers including names, addresses and phone number.

6.8. Standardized work instruction.

The suppliers should document the following sections above using the Nexteer Automotive standardized work instruction form:

- 6.5.10 Machine start-up procedure
- 6.5.11 Calibration procedure, to include special tooling information if required
- 6.5.12 Machine shut-down instructions
- 6.5.14 Automatic cycle sequence of operation and cycle start instructions

The Standardized Work Instruction form and example are available on nexteerdatabexchange.com vendor documents website..

File Naming Convention Examples

1. Machine M Folders (2.2.1)
 - 1.1. 3D Models
 - SS-SD123456-3DD-000-001 – Machine Model, rev 001
 - SS-SD123456-3DD-501-001 – Machine Sub Assemble 1 Model, rev 001
 - SS-SD123456-3DD-001-001 – Detail 1 Model, rev 001
 - SS-SD123456-3DD-027-001 – Detail 27 Model, rev 001
 - 1.2. Assembly/Detail Drawings
 - SS-SD123456-ASM-001-001 – Assembly 1, rev 001
 - SS-SD123456-SUB-501-001 – Sub-assembly 1
 - SS-SD123456-DET-001-001 – Detail 1, rev 001
 - SS-SD123456-DET-027-001 – Detail 27, rev 001
 - 1.3. Operation & Service Manuals
 - SS-SD123456-OSM-000-001.doc – Operation & Service Information (Microsoft Word file)
 - SS-SD123456-OSM-001-001.pdf – Purchased Parts file 1 (Adobe Reader file)
 - SS-SD123456-OSM-002-001.pdf – Purchased Parts file 2 (Adobe Reader file)

 - SS-SD123456-OSM-000-001.pdf – Operation & Service Manual (Adobe Reader file)
2. Tooling Folders (2.2.2)
 - 2.1. 3D Models
 - SS-TL123456-3DD-001-001 – Tool Model 1, rev 001
 - SS-TL123456-3DD-002-001 – Tool Model 2, rev 001
 - 2.2. Assembly/Detail Drawings
 - SS-TL123456-ASM-001-001 – Assembly 1, rev 001
 - SS-TL123456-SUB-501-001 – Sub-assembly 501, rev 001
 - SS-TL123456-DET-001-001 – Detail 1, rev 001
 - SS-TL123456-DET-027-001 – Detail 27, rev 001
3. Machine C Folders (2.2.3)
 - 3.1. Controls Drawings
 - SS-SD123456-ELE-001-001 – Electrical Diagram, Sheet 1, rev 001
 - SS-SD123456-ELE-002-001 – Electrical Diagram, Sheet 2, rev 001

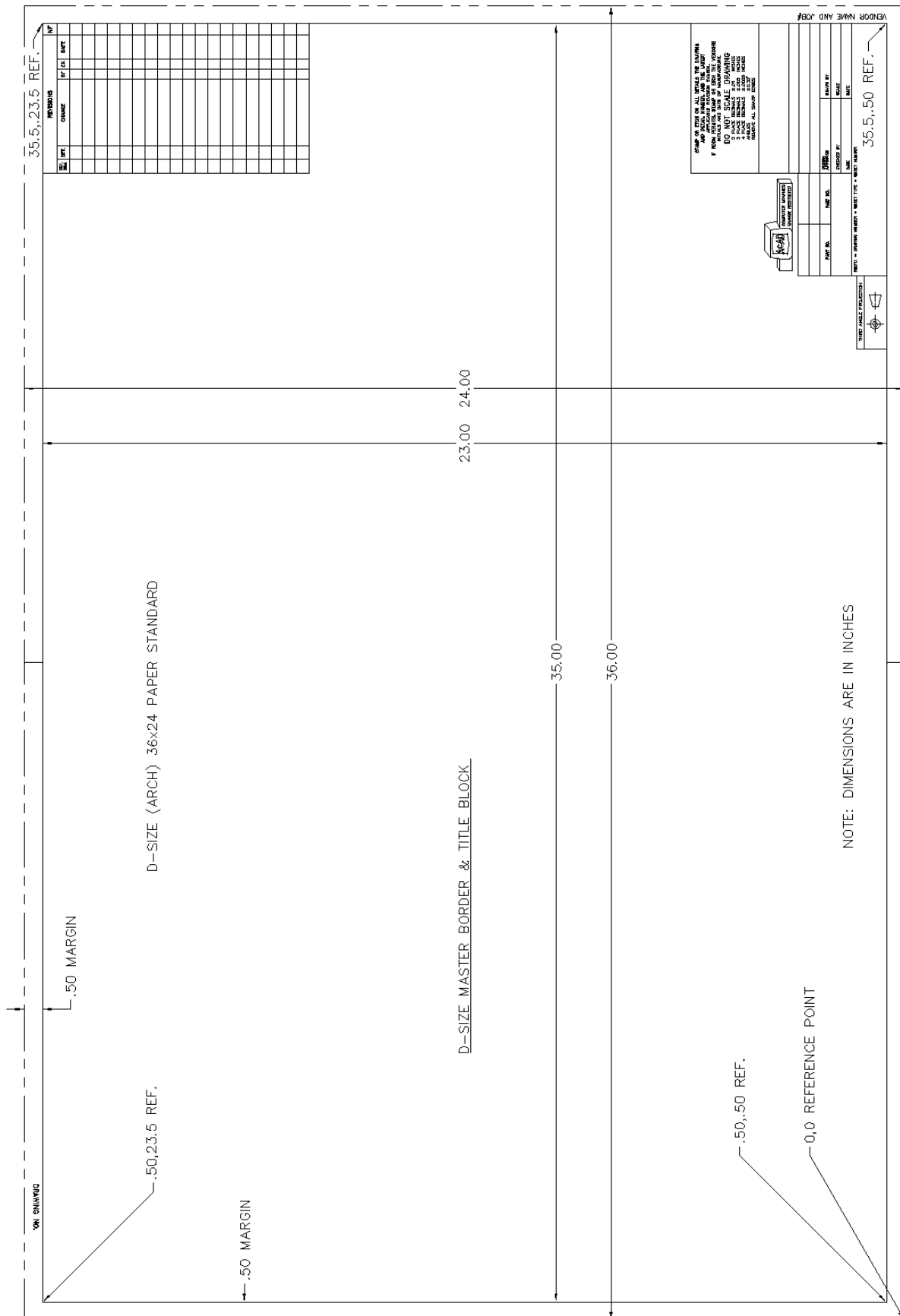
 - SS-SD123456-PNU-001-001 – Pneumatic Diagram, Sheet 1, rev 001

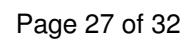
 - SS-SD123456-HYD-001-001 – Hydraulic Diagram, Sheet 1, rev 001
 - 3.2. PDF documentation file
 - SS-SD123456-ELE-000-001.pdf – 1 or more sheets printed as an Adobe Reader file
 - SS-SD123456-ELE-001-001.pdf – sheet 1 (Adobe Reader file)
 - SS-SD123456-ELE-015-001.pdf – sheet 15 (Adobe Reader file)

Notes:

- 1) If sheet 1 is modified and scanned in, it would have the file name
SS-SD123456-ELE-001-002.pdf
- 2) Each time the composite PDF file is updated, the revision number will increment by 1

Master Border & Title Block





Manufacturing Engineering AutoCAD Standard

This appendix describes the requirements and standards that must be followed when AutoCAD is used to develop Manufacturing drawings such as Tooling, Fixture, Gage, Stamp/Die/Mold, Machine, Controls Drawings and Comparator Charts.

1. General Requirements

- 1.1. All geometry representing tooling models must be created true size, using nominal conditions and dimensioned with Associative Dimensioning toggled on. The preferred method is to create geometry with text and title block in model space such that when plotted the text and dimensioning must be legible (e.g. 1/8 in.). Drawing electronic files shall be saved 'Zoomed' to 'Extents'.
- 1.2. Dimensions must not be exploded or changed in the text editor. If the size of the part changes, the change must occur within the model and then reflect the dimension.
- 1.3. All functionally critical fillets and chamfers must be completed and shown. Typical fillets and chamfers may be called out.
- 1.4. AutoCAD provided defaults must be used for fonts, hatch patterns, and line types. If user created defaults are used, the corresponding files must be provided with the drawing file.
- 1.5. All drawing files must be purged of all unused entities before final shipment to Nexteer Automotive. No entities are allowed outside of the title block area.
- 1.6. Model space drawing 'Limits' should be minimized to conserve electronic file size.
- 1.7. All colors and line types are to be assigned BYLAYER. (Changes must be made through layers so they always remain BYLAYER.)
- 1.8. Symbol libraries must be utilized where available.
- 1.9. No shape files will be used; only blocks are permissible.
- 1.10. Vendors must keep a copy of files until successfully uploaded to nexteerdatabase.com.




2. Gage Instruction Requirements

Gage Instructions exist to describe the mastering and gaging instructions for the corresponding gage design. Additional standards for gaging are documented in SD-005.

- 2.1. Gage Instruction Sheet(s) are to be maintained in a single AutoCAD file. Individual Gage Instruction sheets should be compiled onto one (1) drawing file with inserted block title block from the Toolkit and maintained with revision and date control for the entire set.
- 2.2. Gage Instruction standards must be the same as Tooling, Fixture, and Gage drawings and revision/date.
- 2.3. Objects for Gage Instructions must be scaled to fit each sheet.

3 AutoCAD Drafting and Drawing Settings

3.1 Line Type, Layer, and Layer Color

Line & Text Standards								
AutoCAD DATABASE INFORMATION								
Type	Example	Application	Description	Layer Name	Screen Color	Pen Width		Line Type
						mm	in.	
Visible		Optional: For easy viewing of assembly drawing details.	Visible lines are the most prominent lines on a drawing. Lines should be heavy and dense.	Det. #_Detail Name (ASS'Y DRAWINGS)	1-256 (ASS'Y DRAWINGS)	0.50	0.02	Continuous
Visible		To show visible edges to objects on drawings and set-up sheets. This layer should also be used for chart outlines.	Visible lines are the most prominent lines on a drawing. Lines should be heavy and dense.	OBJ	Green (3)	0.50	0.02	Continuous
Hidden		To show hidden features.	Medium width dashes, closely and evenly spaced, and less prominent than visible lines.	HID	Magenta (6)	0.25	0.01	Hidden
Center		To indicate centers and intersection lines.	Narrow lines made up of long and short dashes, spaced and uniform.	CEN	Cyan (4)	0.25	0.01	Center
Dimension, Notes, & Symbols		To show all dimensions, notes, and symbols (i.e. gage arrows, finishes, & rev. balloons)	Dimensions, notes, and symbols should be made with narrow lines.	DIMS	Yellow (2)	0.25	0.01	Continuous
Cutting & Viewing Plains		To indicate where a section or view is taken.	Lines consisting of a long dash and two short dashes. They should be heavier than the visible lines.	CUT	Cyan (135)	0.75	0.03	Phantom
Center Cutting Plains		To indicate where a section is taken when a center line must take precedence.	Lines consisting of a long dash and one short dash. They should be heavier than the visible lines.	CCUT	Cyan (135)	0.75	0.03	Center
Reference Geometry		To indicate geometry that is reference or lines of motion.	Narrow lines made up of long and short dashes, spaced and uniform.	REF	Purple (202)	0.25	0.01	Phantom
View Boundaries		To indicate the boundaries of a sheet size. Pick points for plotting.	Two sets of lines in diagonal corners that represent the outer borders of the sheet.	VIEW_BNDS	Gray (253)	0.25	0.01	Phantom
Cross Sections		To show surfaces exposed by a section cut.	Narrow parallel lines generally drawn at 45 degrees equally spaced, proportionate to the size or mass of the section.	HATCH	Blue (5)	0.25	0.01	Continuous
Object & Tube Breaks		To eliminate repeated detail when overall reference dimensions are shown.	Wide free hand lines for short breaks.	OBJ_BRK	Red (1)	0.50	0.02	Continuous
Dimension Breaks			Ruled and free zig zag lines for long breaks.	DIM_BRK	Yellow (2)	0.25	0.01	Continuous
Phantom Lines		To show parts and there alternate positions.	Narrow lines consisting of a long dash and two short dashes.	PART PART2 PART3	Red (12) Orange (30) Blue (190)	0.25	0.01	Phantom2
Controls	N/A	For various controls applications.	This layer reserved for controls drawings only.	CONTROLS	White (7)	0.25	0.01	N/A
Border	N/A	To plot drawings to a specified scale.	Delphi title blocks.	BORDER	Green (90)	0.75	0.03	Continuous
Border Text	N/A	Described drawing details within border.	Title block text sizes will vary.	BORDER_TXT	Cyan (130)	0.25	0.01	N/A
0	N/A	Block insertion. Nothing else is to be on this layer.	Provides block flexibility. Same characteristics as parent layer.	0	White (7)	N/A	N/A	N/A

3.2 Dimensioning and Text Format

3.2.1. All Dimensions must be Associative. Use the chart below to set preferences.

Associative Dimensioning			
AutoCAD DATABASE INFORMATION			
Variables	Settings		Description
	Metric	English	
DIMASO	ON	ON	Turns on Associative Dimensioning
DIMZIN	0	4	Suppresses leading or trailing zero's
DIMTIH	ON	ON	Horizontal inside text
DIMTOH	ON	ON	Horizontal outside text
DIMTXT	3.0	0.125	Determines the height of the dimension text
TEXTSIZE	3.0	0.125	Determines the height of the text notes
DIMASZ	3.0	0.125	Dimension arrow size

3.2.2 Text Preferences:

1. The font used for general notes and dimensions is **Standard Simplex**, using a recommended character size of 3.0 mm or .125 inches.
2. The font used for section labeling is **Sans Serif Bold**, using a character size of 6.0 mm or .25 inches

Font Name and Type Standards		
AutoCAD DATABASE INFORMATION		
Font Name	Font Type	Description
STANDARD	SIMPLEX.SHX	All Dimensions, Revision Blocks, Text and Notes on drawings
SEC_LABELS	SASB----.PFB	Section Letters and Section Labels
BORDER_TXT	(included in block) ROMANS.SHX	Title Block Text
BORDER	(included in block) ROMAND.SHX	Format Sheet Text (Borders)

Existing Non-Electronic Drawings (Saginaw Site Only)

When updating existing non-electronic drawings reference the following table:

<u>Type of update</u>	<u>Action</u>
Minor change to sheet	Update paper drawing as required
Change requiring redraw of sheet	Use CAD to redraw
New sheet required	Use CAD to create
Lost sheet	Retrieve from Microfilm – Scan (Electronic)
Obsolete Sheet	Obsolete paper drawing

For existing folders, the following physical drawing folders shall be maintained. As drawings are added/redrawn, the CAD files will be stored consistent with the file and folder naming conventions. Reference 2.2.

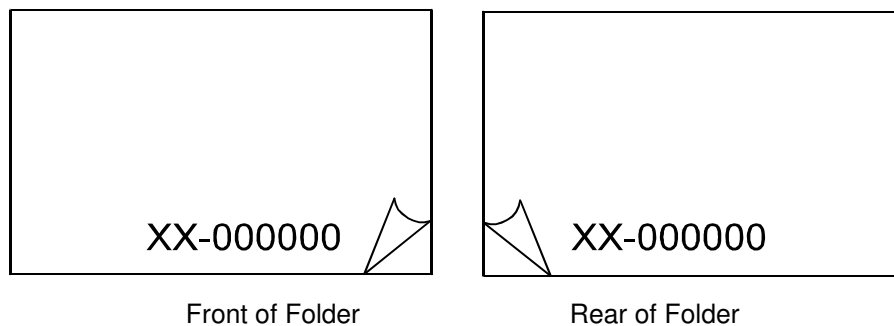
1. All Machine M Folder drawings defined in 2.2.1 must be filed in a folder accommodating its size and identified as follows:

- An SD prefix followed by the equipment number. (Capital Equipment)
- An M(x) prefix followed by the M(x) number. (Non-capital Equipment)
- An EX prefix followed by the equipment number. (Validation)

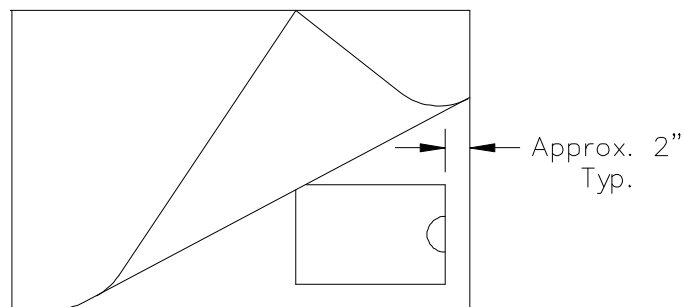
All Tooling Folder drawings defined in 2.2.2 should be filed in a folder identified with the Manufacturing Engineering Drawing Number shown on the drawings.

Multiple folders may be used for designs involving a large number of drawings (a maximum of 25 sheets/folder). In these cases, each folder must have a note indicating the folder number and the total number of folders. The parts list must be filed in folder number one.

The drawing number, including the prefix, must be shown on all drawing folders as indicated below:



Existing, non-electronic parts lists must be filed in the drawing folders in the adhesive backed envelope provided for this purpose. This envelope must be placed on the bottom inside of the drawing folder approximately as shown below:



RECORD OF REVISIONS

Revision #	Date	Section	Description
001	31MY09	All	SD-003-GC was written to replace SD-003 and all SD-003-xxx global site specifications. Original approval & issue date.
002	06NO09	All	Company name updated and "GC" removed from specification number. All SD documents are global common. Sections 2.1.3 and 6.2.3 have been updated.
003	16MA15	2	Chongqing and Liuzhou Site Codes added
004	16MA15	3	AutoCAD format updated to version 2012 and NX format updated to versions NX5 or NX9.
005	16MA15	Multiple	Updated Nexteer supplier web site from nexteersupplier.com to nexteerdatabexchange.com
006	15OC15	2 & 3	Added the requirement to include the Site Code with the Folder Type in the Drawing Prefix
007	15OC15	2	Wuhu Site Code added
008	01MY16	2	Statements added to retain original Site code for all revisions. Indonesia Site Code added
009	01MY16	3	Clarification to allow the hyphen between the Folder Type and Drawing Number to be optional. Clarification of Detail Numbering
010	01MY16	5	Removal of obsoleted requirements and clarification of requirements
011	22AU16	Multiple	Format correction to restore line numbers lost in 01MY16 revision
012	27JL17	3	Solidworks file information added
013	27JL17	2	Wuhan and Morocco Site codes added
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