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1 PURPOSE

- 1.1 The CTQ procedure applies to Engineering drawings where key features (such as dimensions, tolerances, standards, certifications) are uniquely identified as critical to the quality of a part, assembly or system and a process of verification ensues. By noting these features with a “CTQ” flag, a required process of 100% inspection and recording of actual measurement is performed.


2 SCOPE – APPLIES TO WHERE & WHEN THE PROCEDURE IS USED

- 2.1 This procedure applies to all drawings authored by MTS Test Engineering that contain features flagged as CTQ.
- 2.2 This procedure is divided into two workflows. Workflow A for materials purchased from Outside Suppliers and Workflow B for materials from MTS Internal Manufacturing.

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3 DEFINITIONS AND ACRONYMS

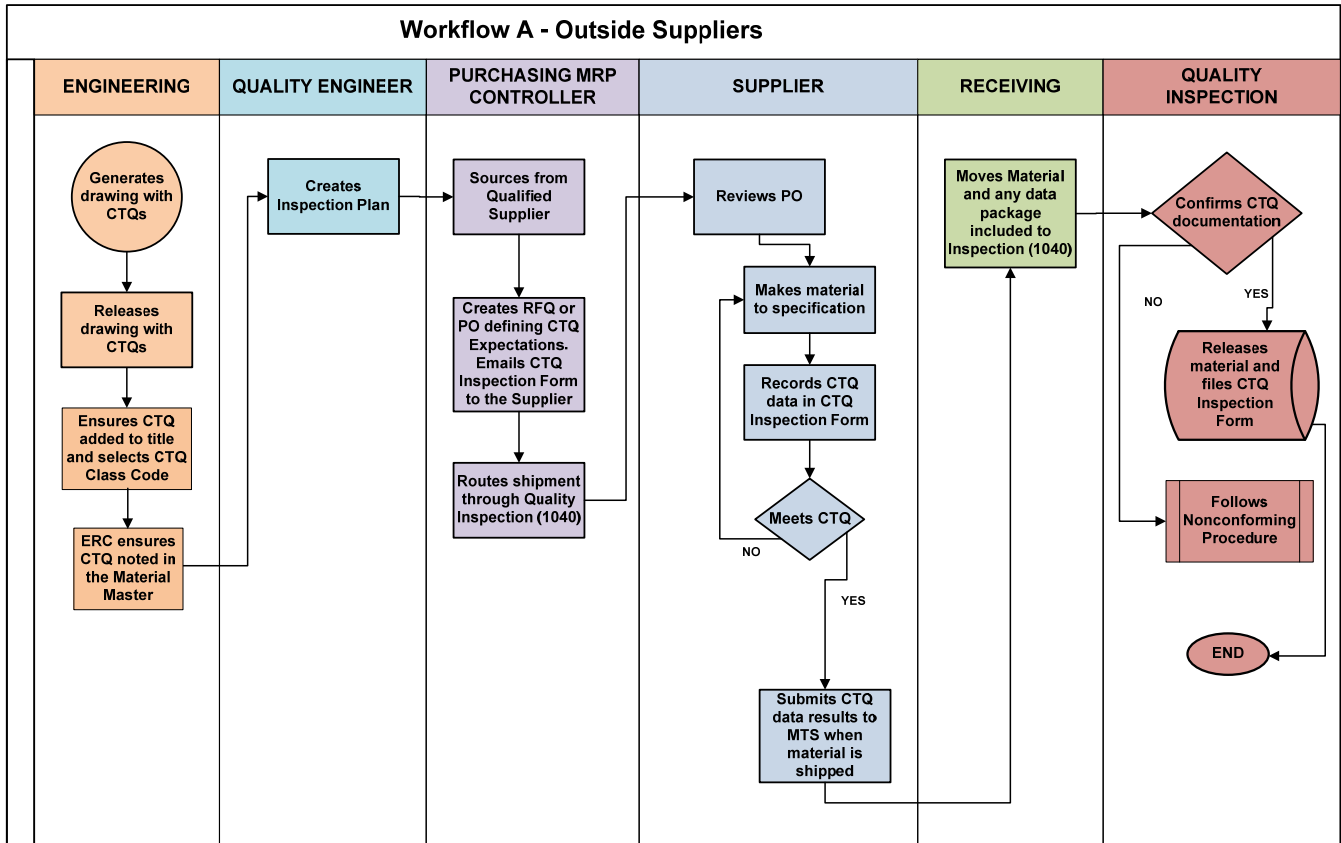
- 3.1 **CTQ** = Critical to Quality (e.g. key characteristics, critical characteristics, critical part characteristics), where 100% inspection and recording of actual measured values are required.
- 3.2 **ECM** = Engineering Change Management
- 3.3 **ECN** = Engineering Change Number
- 3.4 **ERC** = Engineering Records Control
- 3.5 **PO** = Purchase Order


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4 GRAPHIC (IF NEEDED)

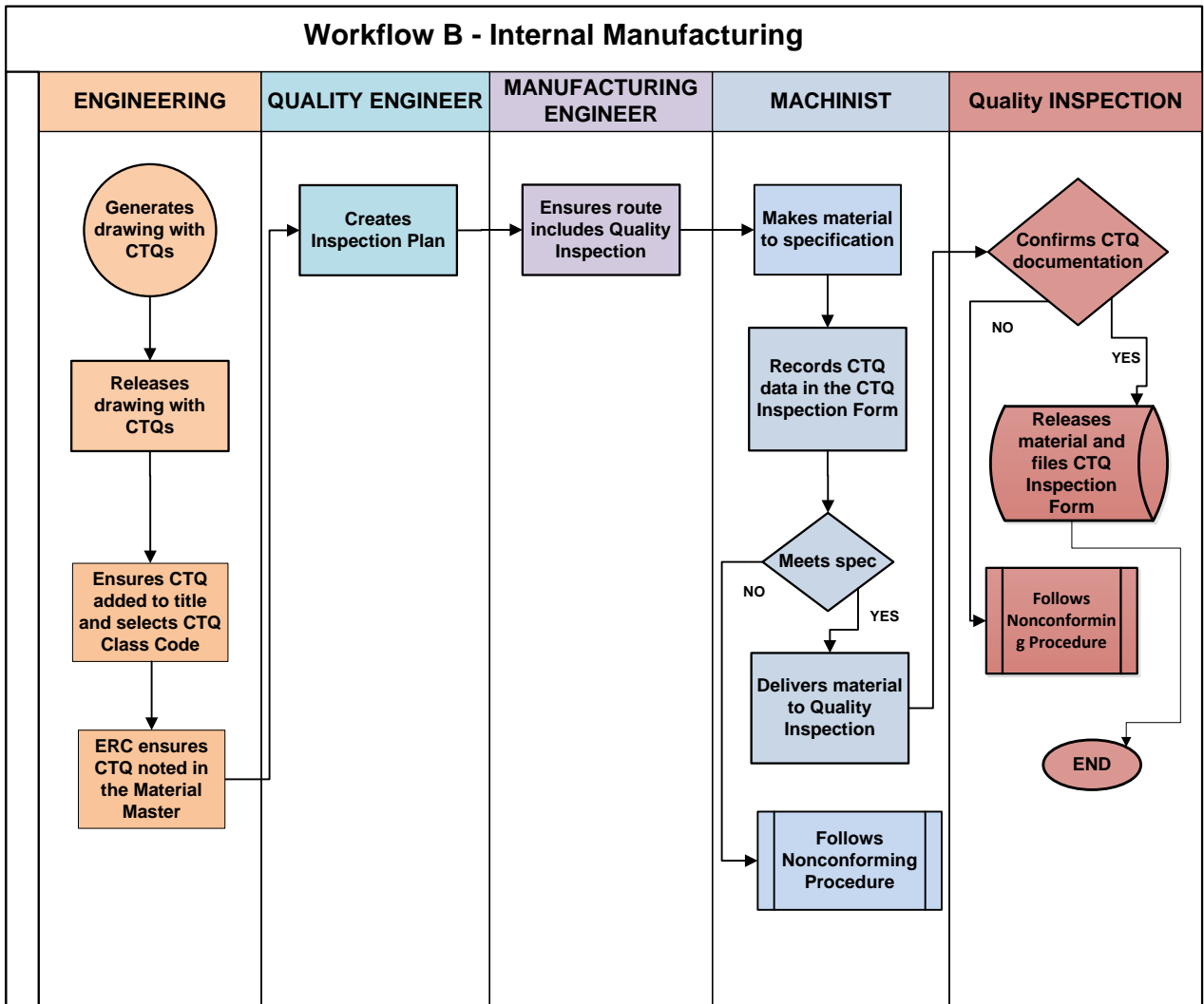
The following charts are intended to provide the user with a high level overview of the CTQ process. More detailed information for each section is provided in subsequent pages.


4.1 Workflow A – Outside Suppliers



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4.2 Workflow B – Internal Manufacturing




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5 RESPONSIBILITIES

- 5.1 **Engineering:** The Responsible Engineer, as defined in SAP, identifies and documents CTQ features on drawing and updates the material description to include “CTQ” at the end of the description name and selects “Yes” for the CTQ class code.
 - 5.1.1 The ECM Material Create procedure should be referenced for more information.
- 5.2 **Engineering Records Control:** Ensures the Material Master class-code is marked with the CTQ flag.
- 5.3 **Supplier Quality Engineer:** Ensures an inspection plan is created in SAP.
- 5.4 For MTS Internal Manufactured CTQ materials:
 - 5.4.1 **Manufacturing Engineer:** Creates route for MTS Internal Manufactured CTQ materials.
 - 5.4.2 **Machinist:** Ensures measurements are taken at the appropriate steps in the process per the CTQ requirements.
- 5.5 For CTQ materials purchased from Outside Suppliers:
 - 5.5.1 **Purchasing MRP Controller:** Selects qualified suppliers and guides them in proper execution of the CTQ procedure. When CTQ requirements exist for material orders, then incoming materials are routed to Quality Inspection in SAP (1040).
 - 5.5.2 **Receiving:** Delivers material to Quality Inspection (1040).
- 5.6 **Quality Inspection:** Validates requirements to CTQ or conducts inspections for 100% of features marked as CTQ (Workflow B). Validates requirement to CTQ as recorded by supplier (Workflow A).

6 PROCEDURE

- 6.1 **Engineering (Lab Office/Responsible Engineer)**
 - 6.1.1 The Lab Office/Responsible Engineer identifies and documents CTQ features on drawing and updates the material description to include “CTQ” at the end of the description name and selects “Yes” for the CTQ class code.
 - 6.1.2 Any application of a CTQ flag should meet at least one of the following criteria:
 - 6.1.2.1 Used when additional dimensional fit, tolerance and/or performance

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values are specified for achieving desired component(s) and assembly level form, fit and function. For example, CTQ flags are applied to “Match Machining” instructions when the dimensions and tolerances of one part are set dependent on the actual, measured dimensions of a mating part (e.g. a pin and bore fit).

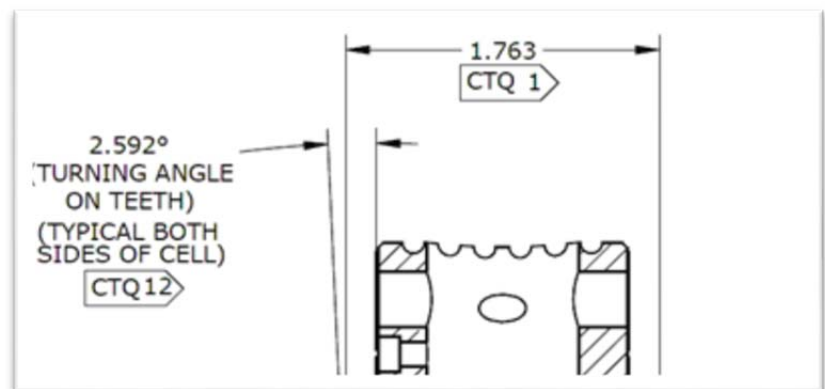
- 6.1.2.2 Used for unique features that are “Critical to Safety” (e.g. pressures).
- 6.1.2.3 Used for critical to compliance requirements (e.g. material/compliance certificates per regulatory or customer requirements).
- 6.1.2.4 When knowing a key attribute is valuable (e.g. related to appearance).
- 6.1.2.5 Used to force an inspection when a feature is unable to be measured later in the process due to the fact that disassembly would ruin the part (e.g. MAST table swivels).

- 6.1.3 Determines disposition of parts if concession to CTQ features are requested.
- 6.1.4 Adjusts CTQ data based on actual outcomes, as needed, through Engineering Change Management System using ECNs.
- 6.1.5 Ensures drawings and the SAP Material Master are properly updated with CTQ flags.


6.2 Design Drafting

- 6.2.1 Applies the CTQ symbol to the drawing in a location that clearly identifies the affected part feature (see illustration 1 below).

6.2.1.1 Illustration 1



- 6.2.1.2 On drawings with more than one CTQ flag, the CTQ flags will be

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numbered to allow correlation to the CTQ Inspection Form (see illustration 1).

6.2.1.3 When more than one of a part is ordered, marking of individual parts in a batch is required to allow correlation of the individual part measurements with the data in the CTQ Inspection Form. A note will be placed on the drawing describing the exact method of part marking required.

6.2.1.4 Adds CTQ as last characters in part description.

6.3 Engineering Records Control

6.3.1 Ensures the Material Master class-code is marked with the CTQ flag.

6.4 Supplier Quality Engineer

6.4.1 Ensures an Inspection Plan is created in SAP.

6.5 Workflow A – Outside Supplier

6.5.1 Purchasing MRP Controller:

6.5.1.1 Emails the CTQ Inspection Form to the supplier when CTQ features are noted in the material description.

6.5.1.2 Routes shipment through Quality Inspection (1040).

6.5.2 Supplier:

6.5.2.1 Review and respond to order documentation.

6.5.2.2 Make material to specification.

6.5.2.3 Performs 100% inspection on all features marked as CTQ.

6.5.2.4 Records CTQ data in MTS provided CTQ Inspection Form. Returns completed CTQ Inspection Form to: CTQ@mts.com.

6.5.2.4.1 If "Pass" (in Spec), then ship in parallel to data.


6.5.2.4.2 If "Fail" (not to Spec prior to preparing the shipment), follow MTS supplier concession process and secure correct level of authorization before shipping to MTS.

6.5.3 Receiving:

6.5.3.1 Moves material to Quality Inspection (1040).

6.5.4 Quality Inspection:

6.5.4.1 Ensures Inspection Lot is created in SAP for the incoming material.

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6.5.4.2 Validates the CTQ data received from supplier and files CTQ related documentation in the SAP Inspection Lot.

6.5.4.3 Performs inspection verification of the part.

6.5.4.4 Releases material to stores or production, if conforming; otherwise initiates NC process.

6.6 Workflow B – Internal Manufacturing

6.6.1 Manufacturing Engineer:

6.6.1.1 Reviews parts in manufacturing queue for CTQ requirements and ensures route includes Quality Inspection (1040).

6.6.2 Machinist:

6.6.2.1 Ensures measurements are taken at the appropriate steps in the process, per the CTQ requirements.

6.6.2.2 Records the CTQ data in the CTQ Inspection Form. Blank forms are found in the network folder: <\\mspdata1\Quality\MASTERS\CTQ>. Partially completed forms are found in the network folder: <\\mspdata1\MachineShop\Common\CTQ>. Forms are saved as: CTQ_Inspection_partnumber_ordernumber.xlsx in the network folder: <\\mspdata1\MachineShop\Common\CTQ>.

6.6.2.2.1 If the parts are within spec, move the parts to the next operation in the process.

6.6.2.2.2 If the parts are not to spec, follow MTS' nonconforming process and secure correct level of authorization before moving on to the next route step.


6.6.2.3 Machinist responsible for the last CTQ feature ensures the CTQ Inspection form is completed and saved to the following network folder: <\\mspdata1\MachineShop\Common\CTQ>.

6.6.2.4 When the next step in the process is Inspection, the parts and job packet are delivered to Quality Inspection.


6.6.3 Quality Inspection:

6.6.3.1 When the parts and job packet are received, locates the CTQ Inspection Form in the following folder location: <\\mspdata1\MachineShop\Common\CTQ>.

6.6.3.2 Validates requirements to CTQ and conducts inspections for 100% of features marked as CTQ.

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- 6.6.3.3 Files the CTQ Inspection Form with the Inspection Lot.
- 6.6.3.4 Releases material to stores or production, if conforming; otherwise initiates the nonconforming process.


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7 ASSOCIATED QUALITY RECORDS – AS STATED IN THE QUALITY RECORDS LIST

Required Record
CTQ Inspection Form
Engineering Drawings & Material Master (with CTQ notation)
Inspection Lot
ECN

8 REFERENCE FORMS / TEMPLATES / DOCUMENTS

Form / Template / Document Title	Location
CTQ Inspection Form (Form number: Q-500.00001)	QMS-Engineering and Project Quality
Engineering Change Management & Material Create Procedure	QMS-Engineering and Project Quality
Nonconforming Process	QMS-Quality
Supplier Concession Request Process	QMS-Materials Management

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9 CURRENT REVISION'S TRAINING REQUIREMENTS


Training requirements are determined by the document owner.

1. Select Awareness **and/or** Formal training requirements.
2. List (below) the functions or groups that require the training.

Select (mark X)	Training Type	Training Definition
	Awareness	Awareness training is conducted by communication, which is sent/delivered by the approver/author/owner of the document to the affected employees/groups.
X	Formal	Formal training requires the approver/author/owner to collect/store evidence that the affected employees/groups were trained.

Functions/Groups that require Formal Training to this procedure:

- Read & Test training will be required for those people assigned the class by their supervisor, including Mechanical Engineers, Mechanical and Electrical Design Drafters, ERC, MRP Controllers, Manufacturing Engineers, Machinists, Material Handlers, Quality Engineers, and Quality Inspectors.
- This will be recorded in the TMS as a course titled QUALITY017_OLT.

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10 REVISION HISTORY & APPROVAL

Revision History			
Rev	Description of Change	Author	Effective Date
A	Initial Release	R. Ingalls	
B	Change CTQ identification	R. Ingalls	03/20/2010
C	Update Workflow B – Internal Manufacturing	R. Ingalls	04/16/2010
D	Update MRP Controller Workflow		06/07/2010
E	Clarify roles and responsibilities (per CA #2830), clarify CTQ application and identification	M. Coburn	06/17/2015

Approval of Current Revision		
Name / Function	Signature	Date
Grant Ovsak / Engineering		
Gene Simon / Operations		
Melissa Coburn / Quality		