

MWI 8715.2

REVISION L-1

EFFECTIVE DATE: January 27, 2017

EXPIRATION DATE: January 27, 2022

---

# MARSHALL WORK INSTRUCTION

## QD01

# CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT) PROGRAM

*With Change 1 (3/17/17)*

**COMPLIANCE IS MANDATORY**

DIRECTIVE IS UNCONTROLLED WHEN PRINTED

Verify current version before use at <https://dml.msfc.nasa.gov/directives>

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 2 of 37</b>

## DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Change/ Revalidation/ Canceled)	Document Revision/ Change	Effective Date	Description
Baseline		12/13/99	
Revision	A	9/15/00	This document is being updated to close RCAR 157. Document numbering revised in accordance with MPG 1410.2, paragraph 3.3.1.1.b.
Revision	B	5/21/01	3.2 added "Training". 3.3 added "Selection of work practices," 3.4 added "Safeguards for personal protection," 4.3 added "Electrical Safety," 4.5 added MWI 8715.15, 5.3 added training requirements, added last sentence to 5.10 and 5.11, 6.7.4 added modified equipment, 6.7.6 added new purchased equipment, 6.9 added and this document, 8.2 added all exposed terminals, 8.2.1 added guard all exposed, 8.3 deleted PPE and special precautions, 8.4 added PPE, 8.5 added JHA, 9.2 added procedures, 9.3 added detailed survey, 9.4 added NSTC 814, 9.5 added certification program, 9.6 added JHA, 9.7 added NSTC 309, 10.1 deleted, 10.1 renumbered, 10.2 added NSTC 814, 10.3.1 deleted, 10.3 added NSTC 309, 10.4 added supervisor shall, 10.4 deleted 10.5 added supervisor ensure, 10.6 deleted, 10.7 deleted.
Revision	C	9/19/2004	Major rewrite, affected all sections, added appendices. Revised per HQ rules review. [Editorial correction to 6.3.15 made by DM on 10/29/2004).
Revision	D	8/4/2005	Major rewrite affected most sections. The rewrite is mostly grammar and intends to make the document flow better, easier to read, and clarifies when a written procedure is required, and when MSFC standardized locks and tags are to be removed and replaced with configuration locks/tags, revised Form 4287.
Revision	E	7/6/2006	Rewrite affecting all sections based on the results of a HQ audit of the LO/TO program. Reduced the size of the document and rearranged some sections and topics to better describe and clarify the process. Clarified requirements for 1) when a written procedure is required, 2) the review and documentation of these procedures, 3) changed information (dates) required on tag to match current tag, 4) developed a standard training for all authorized employees including contractors, 5) better defined the use of configuration locks and tags. Removed Appendices K and Z.
Revision	F	10/10/2007	Revised Applicability, added definition for standard work practice, and added new LO/TO tag. General rewording in most sections in an attempt to provide clearer requirements and make the MWI read easier. Deleted original Appendices H and K.
Revision	G	9/16/2008	Revised 2. Applicability statement to address the applicability of this directive to the Michoud Assembly Facility. Changed Department to Branch and ISD to ISB. Added references to MSFC's MAF. Changed Appendices to Chapters. Moved 2.2 to 6.1. Added reference to MSFC S&MA and Center Operations representative or designee. Minor grammar changes throughout. Added Table of Contents.
Revision	H	3/03/2011	Changed configuration/potential to administrative locks/tags to better line up with terms used at other Centers. Closed IFO Elect findings 001,002, 038. Added Appendix A. Added additional training requirements in 10. Added new 6.4. Deleted flow diagram. Changed MWI 8715.2, "Lockout/Tagout Program" title to better match 1910.147.
Revision	I	10/02/2012	Total Rewrite. Revised per 2011 management review. Deleted Chapters 2 thru 6. Reformatted per MWI 1410.1 revision.
Revision	J	8/8/2013	The update is to cancel OI QD-MAF-002. Added Chapter 3 verification of isolation from energy sources and additional information in Chapter 4

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 3 of 37</b>

			for the process to remove lockout device. The additional information in Chapters 3 and 4 are actions that are currently being done. The update makes the MWI more generic so that it is applicable to both MSFC and MAF. Where applicable, replaced “MSFC and MAF” with “Center” so the instruction is more generic and can be easily applicable to both locations. Where applicable replaced Center specific organization names (ISB, EEOH, FMO and PSO) with the generic terms “Center Safety Office and Center Facilities Management Office” so the instructions can be easily applicable to both locations. Used MSFC or MAF if the instruction is applicable to only one location. Added definitions in Appendix A for “Center Safety Office and Center Facilities Management Office” and identified which org at each location (MSFC or MAF) performs the instruction.
Revision	K	10/3/2014	Update CH2.2 to close 2014 IFO finding, 5.10 for clarification and minor changes to wording in other sections for clarification. Changed S&MA to SMA. Better clarified the SHE 128 training is only awareness training and doesn't include the specific knowledge listed in CH1.1.2 NOTE 1.
Change	1	3/21/2016	On 3/21/16, at the request of the OPRD, an administrative change was made to change Inside Marshall to Explornet Homepage and SHE Webpage to SHE Community. Format italicized NOTES. Change NPR 1441.1 to NRRS 1441.1. Change Part to pt. Change OSHA titles.
Revision	L	1/27/2017	Updated sections 5.3.2, 5.4.1.1, 5.4.2.1, and Chapter 2 to clarify the standardization of Center's standardized lock out and tagout devices. Updated example tagout devices shown in Chapter 2, because H-LKT3 and H-6550 are no longer manufactured under the stock number listed in the note and over a period of time manufacturers will change tag format. Update to clarify closure for NCR 1743 (IFO card 086). Acronyms not spelled out first use of body in MWI per OPRD Tips for writing directives.
Change	1	3/17/2017	On 3/17/17, at the request of the OPRD, administrative changes were made to update Appendix D Records, references to MSFC's Explornet page, and Table of Contents to include chapter subsections.

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 4 of 37</b>

## TABLE OF CONTENTS

<u>PARAGRAPH</u>	<u>PAGE</u>
1. Purpose .....	5
2. Applicability .....	5
3. Authority .....	6
4. Applicable Documents and Forms .....	6
5. Instructions .....	7
5.1 Energy-Control Program .....	7
5.2 Energy-Control Procedures .....	8
5.3 Energy-Control Devices .....	9
5.4 Center Standardized Energy-Control Devices .....	10
5.5 Administrative-Control Locks and Tags .....	12
5.6 Energy-Isolation Mechanism Is Not Capable of Being Locked .....	14
5.7 Group Energy-Control Process .....	14
5.8 Performing Work on Flight Hardware/Systems .....	15
5.9 Shift or Personnel Changes .....	16
5.10 Construction or Offsite Contractors Performing Work Onsite .....	16
5.11 Annual Review of Energy-Control Procedures .....	17
5.12 Temporary Removal of Energy-Control Devices for Testing or Positioning .....	18
5.13 Disciplinary Action .....	19
5.14 Emergency Situations That Require Removal of Energy-Control Device .....	19
5.15 Electrical Panels Locked to Prevent Unauthorized Access .....	19
6. Cancellation .....	20
Chapter 1 Training and Certification .....	21
CH1.1 Authorized Employee .....	21
CH1.2 Affected and Other Employees .....	22
Chapter 2 Center Standardized LO/TO Energy-Control Devices .....	23
CH2.1 LO Energy-Control Devices .....	23
CH2.2 TO Energy-Control Devices .....	24
Chapter 3 Verification of Isolation from Energy Sources .....	25
CH3.1 Verify Prior To Start Of Service/Maintenance Activities .....	25
CH3.2 Verify At Completion Of Service/Maintenance Activities .....	25
Chapter 4 Emergency Removal of Energy-Control Devices When the Employee that Installed the Energy-Control is Absent .....	27
CH4.1 Employee That Installed Energy-Control Devices is Absent .....	27
Appendix A Definitions .....	28
Appendix B Acronyms .....	33
Appendix C Verification Matrix .....	35
Appendix D Records .....	36
Appendix E References .....	37

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 5 of 37</b>

## 1. PURPOSE

To describe the Center’s Control of Hazardous Energy Program and the process for placing energy-control devices on energy sources to prevent employees from being exposed to the unexpected energization, start-up, or release of stored energy as required by NPR 8715.3.

## 2. APPLICABILITY

2.1 This MWI applies to Center personnel, programs, projects, and activities, including contractors and resident agencies to the extent specified in their respective contracts or agreements. (“Contractors,” for purposes of this paragraph, include contractors, grantees, Cooperative Agreement recipients, Space Act Agreement partners, or other agreement parties.)

2.2 This MWI applies to the MAF.

2.3 This MWI applies as follows: all mandatory actions (i.e., requirements) are denoted by statements containing the term “shall.” The terms: “may” or “can” denote discretionary privilege or permission; “should” denotes a good practice and is recommended, but not required; “will” denotes expected outcome; and “are/is” denotes descriptive material.

2.4 This MWI applies the following: all document citations are assumed to be the latest version unless otherwise noted.

2.5 The MWI applies to MSFC-owned equipment/systems operating between 50 and 600 V when the service/maintenance activities on the equipment/system are listed in 29 CFR pt. 1910.147 (a)(2).

*NOTE 1: At MSFC, service and maintenance on equipment/systems operating at 600V or more are under the control of the Redstone Arsenal and are conducted in accordance with their rules and regulations. Contact the Center’s FMO for more information if needed.*

*NOTE 2: At MAF, service and maintenance on equipment/systems operating at 600V or more are under the control of the MAF SACOM and are conducted in accordance with MAF-specific energy-control LO/TO requirements for those voltage levels.*

*NOTE 3: Energy-control (LO/TO) devices are not required in situations where the equipment can be de-energized by an employee with exclusive control of the energy-control device (e.g., cord and plug-connected electrical equipment).*

2.6 This MWI does not apply to equipment/systems operating below 50V if the capacity of the source and any overcurrent protection between the energy source and the worker are considered and it is determined that there will be no increased exposure to electrical burns or to explosion due to electric arcs. (See NFPA 70E Chapter 1.)

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 6 of 37</b>

*NOTE: OSHA has established, in 29 CFR pts. 1910.301 through 399, a threshold value of 50V that requires electric equipment or circuits to be de-energized when employees perform work near or on exposed energized circuit parts. However, other hazards may exist with low voltage electric energy. This 50-volt electric shock threshold does not pertain to the application of 29 CFR pt. 1910.147, and the LO/TO standard would apply to electrical sources (not covered by 29 CFR pt. 1910.301 through 399), or 29 CFR pt. 1910.269) at any voltage whenever there is sufficient energy present to injure employees. (See OSHA CPL 02-00-147 Chapter 3.)*

2.7 The MWI does not apply to service/maintenance activities conducted on equipment/systems listed in 29 CFR pt. 1910.147(a)(1)(ii) and (a)(2)(iii).

*NOTE: Service/maintenance activities such as minor tool changes and adjustments that are routine, repetitive, and integral to the use of the equipment and conducted during normal production operations are not regulated by 29 CFR pt. 1910.147, if the safeguarding provisions of 29 CFR pts. 1910.211 through 219 and 29 CFR pts. 1910.301 through 399, or other applicable portions of 29 CFR pt. 1910 are implemented to prevent worker exposure to the hazards created by the unexpected energization or startup of the equipment/system.*

2.8 This MWI does not apply to service/maintenance activities conducted on equipment/systems under the exclusive control of electric utilities for the purpose of power generation, transmission, and distribution that is regulated by 29 CFR pt. 1910.269 and 29 CFR pts. 1910.301 through 399.

### **3. AUTHORITY**

NPR 8715.3, NASA General Safety Program Requirements

### **4. APPLICABLE DOCUMENTS AND FORMS**

- 4.1 Control of Hazardous Energy (Lockout/Tagout), 29 CFR pt. 1910.147
- 4.2 Machinery and Machine Guarding, 29 CFR pts. 1910.211 through 219 (Subpart O)
- 4.3 Electric Power Generation, Transmission, and Distribution, 29 CFR pt. 1910.269
- 4.4 Electrical, 29 CFR pts. 1910.301 through 399 (Subpart S)
- 4.5 NFPA 70E, Standard for Electrical Safety in the Workplace
- 4.6 NPR 8715.1, NASA Occupational Safety and Health Programs
- 4.7 NPR 8831.2, Facilities Maintenance and Operations Management
- 4.8 NRRS 1441.1, NASA Records Retention Schedules

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 7 of 37</b>

4.9 MPR 3410.1, Training

4.10 MWI 3410.1, Personnel Certification Program

4.11 MSFC Form 4287, MSFC Lockout/Tagout Procedure

## **5. INSTRUCTIONS**

### **5.1 Energy-Control Program**

5.1.1 Service/maintenance activities shall be performed by employees who have been identified as qualified and knowledgeable to perform these types of activities by their supervisor, successfully completed training in energy-control procedures, and is familiar with the Center specific energy-control requirements contained in this MWI.

5.1.2 Service/maintenance activities that require employees to be in or near the equipment/system's danger zone/point of operation shall only be performed after the equipment/systems have been placed in the zero-energy state.

5.1.3 Equipment/systems shall be verified as being isolated from their energy sources and in a safe-work condition prior to the start of any service/maintenance activities. (See Chapter 3 of this MWI for more information.)

5.1.4 The employee performing the service/maintenance activities shall have knowledge of the type of hazards, magnitude of the energy, the specific actions/methods needed to control the hazardous energy for the equipment/system, and be trained and certified in accordance with Chapter 1 of this MWI.

5.1.5 All new equipment/systems purchased, built, or modified at the Center shall be designed to include energy-isolating device so that they are capable of accepting energy-control devices.

5.1.5.1 In situations where the equipment/system's energy-control isolation devices cannot accept an energy-control device the Center' Safety Office shall be notified.

*NOTE: The Center's FMO is also notified when the equipment/system falls under their responsibility.*

5.1.6 When the authorized employee who installed the energy-control device is absent from the worksite and the equipment/system is identified as needing to be energized, the equipment/systems shall be verified as being safe to re-energize by the supervisor of the organization performing the work prior to reenergizing it in accordance with 29 CFR pt. 1910.147(e)(3) and following the processes described in this MWI. (See Chapter 4 of this MWI for more information.)

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 8 of 37</b>

5.1.7 The Center standardized LO/TO energy-control devices described in section 5.4 of this MWI shall be used to control hazardous energy while performing service/maintenance activities unless it is clearly stated in a contract, grant, or written agreement that contractors are permitted to use other types of energy-control devices. (See Chapter 2 and Appendix A of this MWI.)

5.1.8 In the event an exception to section 5.1.7 of this MWI is approved, the Center’s Safety Office shall be notified by the contractor of their LO/TO energy-control program.

*NOTE: The Center’s FMO is also notified for construction.*

5.1.8.1 If multiple contractors are working in the same area and an exception to 5.1.7 has been approved, the Center’s Safety Office shall ensure each contractor is made aware of and familiar with the other contractor’s LO/TO energy-control program in accordance with 29 CFR pt. 1910.147(f)(2) and following the processes described in this MWI.

5.1.9 At MAF, tenant organizations will develop and implement a written energy-control program for their work activities in accordance with the requirements of 29 CFR pt. 1910.147 and following the processes described in this MWI.

*NOTE: The tenant and MAF SMA Manager/QD12 will work together to ensure the tenant’s energy-control program is compliant with MAF specific requirements for controlling hazardous energy during service and maintenance activities.*

## 5.2 Energy-Control Procedures

5.2.1 Energy-control procedures and/or organizational standard energy-control safe-work practices shall be developed and implemented by organizations performing the service/maintenance activities on the equipment/systems.

5.2.2 A written Energy-Control Procedure shall be developed for service/maintenance activities on any equipment/system referred to as “complex” in accordance with 29 CFR pt. 1910.147(c)(4) and (d), and NFPA 70E Chapter 1 and following the processes described in this MWI. (See the definition of “Complex Equipment/System” in Appendix A of this MWI for more information.)

*NOTE 1: Center organizations can elect to use MSFC Form 4287 or an equivalent OSHA-compliant procedure as their written energy-control procedure. MSFC Form 4287 is located on NASA’s “Explornet page,” select “Center,” select “Marshall,” select “Marshall integrated Document Library (MIDL),” select “Forms Management – MSFC Forms.”*

*NOTE 2: At MAF, Energy-control procedures that are written for a specific machine or system are sometimes referred to as HECP.*

*NOTE 3: MSFC’s “Inside Marshall” is located on NASA’s Explornet page.*

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 9 of 37</b>

5.2.3 Energy-control procedures classified as “safety critical” shall be reviewed and approved by the Center Safety Office or designated organization safety representative prior to initiation.

5.2.4 Organizational standard energy-control safe-work practices shall be developed for service/maintenance activities on any equipment/system referred to as “simple.” (See “Simple Equipment/System” in Appendix A of this MWI and 29 CFR pt. 1910.147(c)(4) NOTE for more information.)

5.2.5 A general energy-control procedure is permitted to be developed to cover more than one piece of equipment/system when it can be demonstrated by the equipment/system owner that all of the equipment/systems covered by the general energy-control procedure contain the same hazards and have the same methods of control.

5.2.5.1 General energy-control procedures shall list or identify all equipment/systems that are intended for use. (See CPL 02-00-147 CH 3 for more information.)

*NOTE: General energy-control procedures that are able to be grouped into a single energy-control procedure may be considered as a single procedure for the annual inspection/review.*

5.2.5.2 Equipment/systems powered by the same type electrical panel or same voltage level panel shall not be considered as similar if they do not have the same or similar methods of controls. (See OSHA 3120 for more information.)

5.2.6 Energy-control procedures are only to be written by employees who have successfully completed training in energy-control safe-work practices. (See Chapter 1 of this MWI for more information.)

*NOTE: There is no requirement for employees that write energy-control procedures to be listed in CERTRAK unless they actually place the energy-control device and perform the service/maintenance activity. Construction contractors are not listed in CERTRAK. The construction contractor maintains a list of their personnel that have successfully completed training in energy-control safe-work practices.*

### 5.3 Energy-Control Devices

5.3.1 Energy-control devices shall:

5.3.1.1 Be substantial enough to prevent their removal without the use of excessive force or unusual techniques in accordance with 29 CFR pt. 1910.147(C)(1) and following the processes described in this MWI.

5.3.1.2 Be installed on the equipment/system energy isolation device and placed so that they are clearly visible to employees working in the area.

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 10 of 37</b>

*NOTE: Placing the energy-control devices where they are clearly visible can help ensure every employee understands that removing the energy-control device or attempting to operate the equipment/system by moving the energy-isolation device from the “safe” or “off” position to the “on” position is strictly forbidden.*

5.3.2 Energy-control devices shall be provided to authorized employees by their organization.

*NOTE: The Center’s Safety Office does not provide Center standardized energy-control devices to Center organizations or contractors. (See Chapter 2 of this MWI for more information.)*

#### 5.4 Center Standardized Energy-Control Devices

*NOTE 1: MSFC and MAF use the same Center standardized LO/TO energy-control devices. (See Chapter 2 of this MWI for more information.)*

*NOTE 2: At MSFC, the Center standardized energy-control devices are installed on equipment/system during construction activities even though these activities may not be considered as service/maintenance work. This method helps MSFC ensure consistency by all organizations in the use of the Center standardized energy-control devices when controlling hazardous energy across the Center.*

5.4.1 Center standardized LO energy-control devices shall:

5.4.1.1 Be standardized for the Center as described in Chapter 2 of this MWI.

5.4.1.2 Be installed in such a manner that it will hold the equipment/system energy isolating device in a “safe” or “off” position.

5.4.1.3 Be individually keyed.

5.4.1.4 Identify the authorized employee or organization performing the service/maintenance activity that attached the LO energy-control device in accordance with 29 CFR pt. 1910.147(c)(4)(D) following the processes described in this MWI. (See Chapter 2 of this MWI for more information.)

*NOTE: The attachment of the Center standardized TO energy-control device identified in section 5.4.2 of this MWI to the Center standardized LO energy-control device is permitted to serve as this method of identification. The method of attaching the tag to the lock should be substantial enough that it will prevent inadvertent or accidental removal of the tag from the lock. See section 5.4.2.6 of this MWI for more information.*

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 11 of 37</b>

5.4.1.5 Be the only devices permitted to serve as LO energy-control devices during service/maintenance activities on equipment/systems while an authorized employee is actually performing work in the danger zone at the Center in accordance with 29 CFR pt. 1910.147 (c)(5)(B) and following the processes described in this MWI. (See Chapter 2 of this MWI for more information.)

*NOTE 1: Exception 1 to 5.4.1.5. Center standardized LO energy-control devices are permitted to be installed on equipment/systems for a specified period of time during a planned/scheduled power outage, or for the period of time necessary to complete the service/maintenance work on an approved FWR, TPS, or other approved WAD. At the end of the specified period, the Center standardized LO energy-control devices are removed.*

*NOTE 2: Exception 2 to 5.4.1.5. An administrative-control or personal lock and tag is permitted to be attached in addition to a Center standardized LO/TO energy-control device during service/maintenance activities. Equipment/system operators are permitted to attach an administrative-control or personal lock and tag when they are not in the area and when the equipment/system is not energized or being operated. There are times when the service/maintenance activities are scheduled while the equipment/system operator is not in the area, so their administrative/personnel lock and tag are not removed. This situation is similar to a group energy control process.*

5.4.1.6 Be removed from the energy-isolation mechanism when no work is actually being performed and replaced with an administrative-control lock and tag when the equipment/system is not safe to re-energize. (See section 5.5 of this MWI for more information.)

5.4.1.7 Not be used for any other purpose, such as administrative-control or personal locks.

5.4.1.8 Be tagged with the Center standardized TO energy-control device. (See section 5.4.2 and Chapter 2 of this MWI for more information.)

5.4.1.9 Be removed and replaced with administrative-control locks and tags for any of the reasons listed in section 5.5 of this MWI.

5.4.2 Center standardized TO energy-control devices shall:

5.4.2.1 Be standardized for the Center as described in Chapter 2 of this MWI.

5.4.2.2 Be installed in such a manner that it clearly indicates that the operation or movement of energy isolating devices from the “safe” or “off” position is prohibited.

5.4.2.3 Identify the authorized employee or organization performing the service/maintenance activity that attached the TO energy-control device in accordance with 29 CFR pt. 1910.147(c)(4)(D) following the processes described in this MWI. (See Chapter 2 of this MWI for more information.)

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 12 of 37</b>

5.4.2.4 Be maintained in a legible condition and replaced when discovered illegible. (See CFR pt. 1910.147 (c)(5)(A) for more information.)

5.4.2.5 Be attached to the Center standardized LO energy-control device.

5.4.2.6 Be provided with a means of attachment that are substantial enough to prevent inadvertent or accidental removal in accordance with 29 CFR pt. 1910.147(C)(2) and following the processes described in this MWI.

a. For tags, the attachment means shall be a non-reusable, self-locking, one piece nylon tie wrap of sufficient size/length that has the basic required characteristics and can withstand the environmental conditions used, and with a minimum unlocking strength of 50 pounds.

*NOTE 1: A one (1) piece nylon tie wrap of sufficient size/length has the basic required characteristics and is recommended, if it can withstand the environmental conditions used.*

*NOTE 2: Samples of Center standardized energy-control devices can be displayed by the Center's Safety Office, Center's FMO, and/or other onsite organizations responsible for requesting offsite contractors to perform work during contractor in-briefings, when requested. (See Chapter 2 of this MWI for more information.)*

*NOTE 3: Center standardized energy-control devices can be obtained from local vendors.*

## 5.5 Administrative-Control Locks and Tags

5.5.1 Administrative-control locks shall:

5.5.1.1 Not be the same colors as the Center's standardized LO/TO energy-control devices listed in section 5.4 of this MWI.

5.5.1.2 Be installed in such a manner that it clearly indicates that the operation or movement of energy isolating devices from the "safe" or "off" position is prohibited.

5.5.1.3 Be utilized to prevent injury or unsafe operation of the equipment/system.

5.5.1.4 Be installed when work has not been completed and the equipment/system is not in a condition where it is safe return to service. This condition may occur when the work has not been completed by the end of the shift, workday or the estimated completion date shown on the FWR, TPS or WAD. (See 5.4.1.6 of this MWI for more information.)

5.5.1.5 Be installed when delays have occurred such as waiting for a design change or delivery of replacement parts.

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 13 of 37</b>

5.5.1.6 Be installed when the equipment/system is not undergoing service/maintenance activity, but hazardous energy is needed to be positively controlled.

5.5.1.7 Be installed to keep the equipment/system in the “off” position when it is not safe to operate.

5.5.1.8 Be installed to keep the equipment/system in the “on” position to prevent someone from inadvertently turning it off, when needed.

5.5.1.9 Be installed to keep unauthorized employees from operating the equipment/system.

5.5.1.10 Be installed to lock the energy-isolation device to support safe removal of “abandoned in place” items from periodic maintenance and inspection schedules.

*NOTE 1: MSFC does not have Center standardized administrative-control or personal locks or tags. The lock used to maintain a certain configuration/position of the equipment/system can be any size or shape necessary to safely lock the equipment/system in the desired configuration/position, so long as it does not have a “red” case as described in Chapter 2 of this MWI. Administrative-control or personal locks are recommended to be accompanied with an administrative-control and personal tag. The preferred method of identification is with an administrative-control or personal tag.*

*NOTE 2: MAF uses the term Configuration Locks and Tags.*

5.5.2 Administrative-control and personal tags shall:

5.5.2.1 Not be the same colors as the Center’s standardized energy-control devices as described in section 5.4 and Chapter 2 of this MWI.

5.5.2.2 Be installed in such a manner that it clearly indicates that the operation or movement of energy isolating devices from the “safe” or “off” position is prohibited.

5.5.2.3 Identify the organization, code or name of employee.

5.5.2.4 Provide a contact phone number or organization code.

*NOTE: The installation of a lock with an administrative-control or personal tag will be based on the hazard level as determined by the employee installing the tag. It is highly recommended to always install a lock if the energy-isolation device is capable of accepting a locking device.*

5.5.2.5 Be maintained in a legible condition and replaced when they are discovered illegible.

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 14 of 37</b>

5.5.2.6 Be constructed such that it is sufficiently durable and can withstand the environmental conditions where it is used.

5.5.2.7 Include a WAD when applicable.

5.5.2.8 At MAF, be colored “orange.”

## 5.6 Energy-Isolation Mechanism Is Not Capable of Being Locked

5.6.1 A TO energy-control device shall not be permitted to be used without a LO energy-control device for energy-control during service/maintenance activities unless the following can be satisfied:

5.6.1.1 It is demonstrated by the organization performing the service/maintenance activity that the energy-isolation device is not capable of being locked.

5.6.1.2 It is demonstrated by the organization performing the service/maintenance activity that the use of a TO energy-control device alone can provide “full employee protection” and the same level of protection that is provided by the use of a LO energy-control device in accordance with 29 CFR pt. 1910.147(c)(3) and following the processes described in this MWI.

5.6.1.3 Approval is obtained from the authorized employee’s supervisor and the Center’s Safety Office and Center’s FMO.

5.6.2 Additional safety measures shall be taken in order to provide full employee protection in situations when only a TO energy-control device can be used and these additional safety measures are noted on the tag.

*NOTE: Removing fuses or lifting wires can help provide full employee protection.*

5.6.3 TO energy-control devices, when approved for use, and their means of attachment shall be substantial enough to prevent inadvertent or accidental removal in accordance with 29 CFR pt. 1910.147(C)(2) and following the processes described in this MWI.

## 5.7 Group Energy-Control Process

5.7.1 When a service/maintenance activity on equipment/systems involves more than one employee from a craft, crew, or department, a group energy-control procedure shall be developed.

5.7.2 The group energy-control procedure shall:

5.7.2.1 Identify an authorized employee to serve as the energy-control coordinator for the group energy-control activity.

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 15 of 37</b>

5.7.2.2 Be communicated by the organization that developed the group energy-control procedure to all employees involved in the service/maintenance activity prior to the start of work. (See 29 CFR pt. 1910.147(c), (d) and (f) for more information.)

5.7.2.3 Require each authorized employee to affix a personal LO/TO energy-control device to the group lockout device, group lock box, or comparable mechanism before work begins, and each employee remove their devices when work on the machine or equipment being serviced or maintained is completed.

*NOTE: For example, if three electricians are assigned to work together to repair an electrical problem, one person may be assigned as the energy-control coordinator for the group and be the only member of the crew to install and remove energy-control devices from the equipment/system. The energy-control coordinator also places energy-control device keys in a lock box and each member of the group affixes their personal energy-control device to the lock box with a multi-lock hasp.*

5.7.2.4 Require the energy-control coordinator to install the energy-control devices necessary to safely secure the system, machine or equipment for the crew or group prior to the start of service/maintenance activities and remove it when the service/maintenance activities are completed.

## 5.8 Performing Work on Flight Hardware/Systems

5.8.1 Special situations arise during the troubleshooting/testing of flight hardware/systems during their development where the employees that work on the hardware/system are not trained/certified as a LO/TO authorized employees, but the use of the Center’s standardized energy-control devices is necessary to ensure everyone involved in the activity is adequately protected.

5.8.2 The following steps address these situations and are only permitted when LO/TO training/certification as an “authorized employee” is not needed based on the employee’s everyday/normal job assignments and they are assigned to troubleshoot/test the flight hardware/systems.

5.8.2.1 A group energy-control coordinator (who is trained/certified as an authorized employee) shall be appointed by the organization assigned primary responsibility for the troubleshooting/testing of the flight hardware/system and performing all the responsibilities listed in section 5.7 of this MWI for coordinating the activity.

5.8.2.2 The energy-control coordinator shall use a lock box or group multi-lock hasp for this energy-control activity.

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 16 of 37</b>

5.8.2.3 Each employee that is expected to perform work and is not trained as an authorized employee shall be provided with an administrative-control or personal lock and tag to place on the lock box or group multi-lock hasp while they are working on the flight hardware/system and will remove their lock and tag when their work is complete.

5.8.2.4 The energy-control devices provided in section 5.8.2.3 of this MWI shall contain the name of the employee that places the energy-control devices on the lockbox or group multi-lock hasp when performing work.

## 5.9 Shift or Personnel Changes

5.9.1 In situations where service/maintenance activities are ongoing during shift or personnel changes, an orderly transfer of the energy-control devices shall occur between the arriving shift and the leaving shift to ensure there is no gap in coverage between the leaving employee's removal of their energy-control devices and the placement of the energy-control devices by the arriving employees in accordance with 29 CFR pt. 1910.147(f)(4) and following the processes described in this MWI.

5.9.2 A physical transfer of energy-control devices that were installed during the initial shut-down of the equipment/system between leaving and arriving employees is the most common method.

5.9.2.1 A visual inspection of the energy-control devices shall be made by the arriving employees, of locks and tags that were previously installed during the initial shut-down of the equipment/system.

5.9.2.2 The acceptance of the energy-control transfer shall be annotated and initialed on the energy control procedure when applicable.

5.9.3 When there is a gap between shifts and a physical transfer of energy-control devices between the leaving and arriving shifts is not possible, an administrative-control lock and tag shall be installed to maintain the equipment/system in a de-energized condition.

5.9.3.1 In this situation, prior to resuming any service/maintenance activities the arriving employee shall start the energy-control process from the beginning by verifying the equipment/system is still de-energized, isolated from all hazardous energy sources, and in a safe work condition.

## 5.10 Construction and Offsite Contractors Performing Work Onsite

5.10.1 Construction and offsite contractors shall be permitted to perform energy-control activities/procedures on the Center after they have successfully completed the Center's LO/TO orientation training. This training contains specific requirements for the contractor to follow while performing this type work on Center in accordance with 29 CFR pt. 1910.147(f)(2) and

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 17 of 37</b>

following the processes described in this MWI. (See Chapter 1 of this MWI for more information and Appendix A of this MWI for the definition of an Offsite contractor.)

*NOTE: This training is intended for the contractor employees performing the hands on work when hazardous energy is needed to be controlled.*

5.10.1.1 Construction contractors shall notify the Center’s FMO to request the Center’s LO/TO orientation training.

5.10.1.2 Offsite contractors that are not considered as construction contractors shall notify the Center’s Safety Office to request the Center’s LO/TO orientation training.

*NOTE: Construction and Offsite contractors may be permitted to provide the Center’s LO/TO orientation training to their employees after obtaining concurrence to provide this training from the Center’s Safety Office and Center’s FMO for construction.*

#### 5.11 Annual Review of Energy-Control Procedures

5.11.1 Energy-control procedures shall be reviewed by the organization that developed and used the procedure to perform the energy-control activity in order to verify the procedures are adequate and are being properly applied by their employees in accordance with 29 CFR pt. 1910.147(c)(6).

*NOTE 1: The review of the written energy-control procedures is conducted at least annually (based on twelve-month intervals). This review also includes a review of any organizational standard energy-control safe-work practices (if applicable) developed and used by the organization when a written energy-control procedure is not required. Energy-control procedures that are used less frequently than once a year (based on twelve-month intervals) can be inspected when used.*

*NOTE 2: The Center’s Safety Office may participate in the annual review if requested by the developing organization.*

5.11.2 The annual review shall be performed by an authorized employee within the organization that developed the procedure and include an examination of the following:

5.11.2.1 The steps in energy-control procedure are being followed by the authorized employee;

5.11.2.2 The employees involved are familiar with and know their responsibilities under the procedure;

5.11.2.3 The employees are proficient in implementing the requirements of the energy-control procedure; and

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 18 of 37</b>

5.11.2.4 The energy-control procedure is adequate to provide the necessary protection.

5.11.3 The annual review shall not be performed by the authorized employee that performed the energy-control activity unless accompanied by another reviewer.

*NOTE 1: In organizations that have very few LO/TO authorized employees who perform all energy-control activities it may be impossible to have the review performed by an employee that did not perform the energy-control procedure being reviewed. Contact the Center's Safety Office for assistance in these situations.*

*NOTE 2: The review can be conducted during random audits or planned visual observations by an authorized employee other than the one(s) utilizing the energy-control procedure. The preferred method to conduct a review of an energy-control procedure is for an authorized employee, other than the one(s) utilizing the energy-control procedure, to observe another authorized employee implement the energy-control procedure. This method allows for the observer to discuss the energy-control procedure with employee performing the energy-control activity to determine if the employee understands all of the requirements contained in the energy-control procedure and if the energy-control procedure is being followed.*

*NOTE 3: The annual review of an energy-control procedure may coincide with equipment/system preventive maintenance or inspection activities/schedules.*

5.11.4 If it is not possible to perform the review while the actual energy-control procedure is being performed, then an authorized employee that is independent from energy-control procedure being reviewed shall review the energy-control procedure with all those authorized employees who use that procedure in a meeting by reviewing the documented procedure(s) and ensuring each user understands it. (See OSHA Standard Interpretation Letter 10/29/1996 – “Consultants performing lockout/tagout periodic inspections” for more information.)

*NOTE: Energy-control procedures can be reviewed individually or directly-related procedures can be grouped together into a single procedure for review purposes if they can meet the requirements identified for grouping procedures.*

5.11.5 Energy-control procedures shall be revised when changes are needed.

5.11.6 The review of energy-control procedures can be conducted at any time, but shall not exceed one-year intervals from the time it was used.

5.11.7 The date and names of the participants involved in the annual procedure review shall be documented in accordance with 29 CFR pt. 1910.147(c)(6)(ii) and this MWI.

## 5.12 Temporary Removal of Energy-Control Devices for Testing or Positioning

LO/TO energy-control devices shall be permitted to be temporarily removed from the energy-isolating mechanism to permit energization for testing or positioning of the equipment/system or

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 19 of 37</b>

component to make fine adjustments or to troubleshoot, to identify the source of the problem and verify the problem has been corrected in accordance with 29 CFR pt. 1910.147(f)(1) and following the processes described in this MWI.

### 5.13 Disciplinary Action

5.13.1 Any employee discovered disturbing the controls, energy-isolating mechanisms, and/or energy sources for any equipment/system or component where an LO/TO energy-control device has been installed, or attempting to remove an LO/TO energy-control device shall be subject to disciplinary action.

5.13.1.1 Civil service employees shall be subject to disciplinary action in accordance with the NASA Desk Guide for Table of Disciplinary Offenses and Penalties. This document can be viewed on MSFC's "Inside Marshall," select "Organizational Websites," locate "Safety and Mission Assurance Directorate," select "Safety, Health, and Environment," select "SHE Policies and Procedures."

5.13.1.2 Onsite and offsite contractor employees shall be subject to disciplinary action as determined by the CO and/or COR, or requesting organization and as agreed upon with the contractor.

### 5.14 Emergency Situations That Require Removal of Energy-Control Devices

5.14.1 A Center standardized LO/TO energy-control device shall always be the first choice to control hazardous energy during emergency service/maintenance activities. However, emergencies sometime arise where the Center standardized LO/TO energy-control device is not available at the time of need. In these emergencies, use any type of lock necessary to safe the system.

*NOTE: The preferred method is to paint the lock case "red" in accordance with Chapter 2 of this MWI if possible.*

5.14.2 Center standardized LO/TO energy-control devices shall be installed after the emergency situation has been controlled if work is still being performed to the equipment/system.

### 5.15 Electrical Panels Locked to Prevent Unauthorized Access

5.15.1 At MSFC, electrical panel controlling infrastructure equipment and systems and some user owned equipment and systems are locked with a FMO lock to prevent unauthorized access to the circuit breakers within the panel. Applying a LO energy-control device to a circuit breaker within the panel may prevent the electrical panel door from fully closing and prevent the FMO lock from being applied to prevent unauthorized access into the electrical panel. In these situations one of the following shall be permitted:

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 20 of 37</b>

5.15.1.1 The Center’s standardized LO energy-control devices are applied to the breaker and the panel door remains unlocked for the period of time the Center’s standardized LO energy-control devices are applied.

5.15.1.2 The Center standardized TO energy-control device is applied to the breaker, so that the panel door can fully close and the FMO lock is attached to lock the panel door. Concurrence that this method provides full employee protection in accordance with section 5.6 of this MWI is needed from the authorized employee’s supervisor, Center’s Safety Office and Center’s FMO.

## **6. CANCELLATION**

MWI 8715.2K, Control of Hazardous Energy (Lockout/Tagout) Program, dated October 3, 2014.

*Original signed by*

Todd A. May  
Director

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 21 of 37</b>

## **CHAPTER 1 Training And Certification**

### **CH1.1 Authorized Employee**

CH1.1.1 Employees designated to perform energy-control activities and are identified as a LO/TO “authorized employees” for their organization shall successfully complete one of the following:

CH1.1.1.1 At MSFC, SHE 128, “MSFC Lockout/Tagout Training” and the associated written LO/TO test.

CH1.1.1.2 At MAF, MAF SHE 128, “MAF Lockout/Tagout Training” and the associated written LO/TO test.

*NOTE 1: MSFC SHE 128, “MSFC Lockout/Tagout Training” is the Center’s orientation training for the control of hazardous energy and is intended to communicate NASA and Center specific requirements for work that involves the control of hazardous energy while performing service/maintenance activities on the Center. This training is awareness training and does not provide the level of detail necessary for the following: (1) For a supervisor to consider an employee as “qualified or authorized” to perform service/maintenance activities on specific types of equipment/systems; (2) The employee’s ability to perform service/maintenance activities on specific types of equipment/systems in a safe manner; (3) The employee’s ability to recognize the hazardous energy sources applicable to the specific equipment/system being serviced/maintained; (4) The employee’s ability to determine the type and magnitude of various energy sources available in the workplace; (5) The methods and means necessary to isolate and control hazardous energy for the specific equipment/systems when being serviced/maintained; and (6) When to determine the employees needs retraining.*

*NOTE 2: Initial LO/TO training for “authorized employees” may be provided by an instructor in a classroom atmosphere or obtained via Web-based training based on the employee’s previous training, qualifications, and knowledge of this subject as determined by the supervisor.*

*NOTE 3: Onsite contractors may provide the SHE 128, “MSFC Lockout/Tagout Training” to their trained, qualified and knowledgeable employees. Contact the Center’s Safety Office for a copy of this training.*

*NOTE 4: Instructor led “Lockout/Tagout Training” may be provided by the Center’s Safety Office or by the employee’s supervisor. Contact the Center’s Safety Office for a copy of this training and additional information.*

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 22 of 37</b>

CH1.1.2 All of the training requirements identified in MWI 3410.1 for an authorized employee shall be completed prior to obtain certification.

CH1.1.2.1 After completing all training requirements, the authorized employee will be listed in CERTRAK by the Center’s CERTRAK Administrator. Employees are not considered as “certified authorized employees” until they are listed in CERTRAK.” (See MWI 3410.1 for more information.)

CH1.1.3 Employees shall not be considered authorized to control hazardous energy and serve in the role of a Center “authorized employees” during servicing and maintenance activities on equipment/systems until they are listed in CERTRAK.

*NOTE: Construction contractors are not listed in CERTRAK. The construction contractor maintains a list of their personnel that have successfully completed SHE 128, “MSFC Lockout/Tagout Training” training and are designated as LO/TO “authorized employees” for their work on Center.*

CH1.1.4 Authorized employees shall be retrained in SHE 128, “MSFC Lockout/Tagout Training” whenever an annual inspection/review reveals, or there is reason to believe, that there are deviations from or inadequacies in the employee’s knowledge or use of Center energy-control procedures.

CH1.1.5 Authorized employees shall be decertified and removed from CERTRAK if they are discovered deliberately violating or not adhering to the Center energy-control requirements contained in this MWI.

## CH1.2 Affected and Other Employees

CH1.2.1 Employees identified as “affected and other employees” shall successfully complete SHE 101, “Safety, Health and Environmental Program” training.

*NOTE: Organizations that regularly perform energy-control activities or in areas where energy-control activities are frequently performed, may elect to provide LO/TO orientation training on a more frequent basis. Supervisors may provide SHE 127, “Lockout/Tagout Training for Affected and Other Employees” as a topic during a monthly safety meeting. This training is located on the NASA SATERN training Web site or contact the Center’s Safety Office to obtain a copy of this training.*

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 23 of 37</b>

## CHAPTER 2 Center Standardized LO/TO Energy-Control Devices

### CH2.1 LO Energy-Control Devices

CH2.1.1 The Center’s standardized LO energy-control device shall be standardized by a lock with a red-colored case. (See 29 CFR pt. 1910.147(c)(5) for more information on being standardized.)

*NOTE: These locks can be manufactured with a red-lock case or can be any lock that has a red sleeve slide over the lock case. (Heavy duty sleeves that slide over the lock case and need to have heat applied to them in order to shrink the sleeve to a snug fit.) Acceptable sleeves for this purpose include the LockWrap Color-Coded Padlock Sleeve or equivalent red padlock sleeve.*

CH2.1.2 Locks that have only a red band or strip around the case shall not be permitted for use as Center standardized lockout devices.



Example: Example of a **red sleeve** that slides over the lock case and heat shrunk to ensure a snug fit which is placed on a lock case to identify it as a Center standardized lockout device.



Example of a **red-lock case** that identifies a Center standardized lockout device for energy-control.

CH2.1.3 The lockout device shall identify the employee or organization responsible for the lockout device and a contact phone number.

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 24 of 37</b>

## CH2.2 TO Energy-Control Devices

CH2.2.1 The Center’s standardized TO energy-control device shall be standardized by a tag containing the following:

CH2.2.1.1 The colors white, red, and black.

CH2.2.1.2 “Red” diagonal strips on a white background. The “red” diagonal strips may be on one or both sides of the tag.

CH2.2.1.3 Contain any combination of the following: “LOCKED OUT,” “EQUIPMENT LOCKED OUT,” “DANGER – DO NOT OPERATE,” or “DANGER - DO NOT ENERGIZE.”

CH2.2.1.4 Be approximately 3 inches wide and 5 5/8 inches long. (See 29 CFR pt. 1910.147(c)(5) for more information on being standardized.)

*NOTE: Below are examples of tags meeting the Center’s standardized specifications listed in CH2.2 and are available from a variety of vendors and manufactures. Contact the Center’s Safety Office for more information.*



CH2.2.2 At a minimum, all of the information requested on the tag shall be completed.

*NOTE: Normally this information includes the following: (1) employee’s name, (2) organization or phone number, and (3) a brief description of the work being performed. The information can vary depending on the tag manufacturer.*

CH2.2.3 In cases where the Center standardized tag is expected to be installed for a period of time in accordance with section 5.4.1.5 NOTE of this MWI and employees are not to be actively performing service/maintenance on the equipment/system, a work authorization document number shall be included on the tag.

CH2.2.4 Manufacture tags may contain slight variations in the criteria listed in CH2.2. Contact the Center’s Safety Office for concurrence prior to use of these tags.

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 25 of 37</b>

## **CHAPTER 3 Verification of Isolation From Energy Sources**

### **CH3.1 Verify Prior To Start Of Service/Maintenance Activities**

CH3.1.1 Prior to starting any service/maintenance activities, the authorized employee shall complete the following steps:

CH3.1.1.1 Determine all possible sources that supply any form of hazardous energy to the specific equipment/system requiring service/maintenance.

*NOTE: This can be accomplished by checking applicable up-to-date drawings, diagrams, and identification tags.*

CH3.1.1.2 Notify the affected employees that equipment/system is scheduled to be de-energized to perform service/maintenance activities.

*NOTE: Notification is given prior to shutting down the equipment/system.*

CH3.1.1.3 Shut down the equipment/system by interrupting and isolating all hazardous energy sources to the equipment/system.

*NOTE : At a minimum, the shutdown can include opening breakers or disconnect switches, closing or opening valves, or placing blocks and other measures as determined necessary to interrupt and isolate the energy sources.*

CH3.1.1.4 Release all stored or residual energy.

CH3.1.1.5 Apply energy-control devices.

CH3.1.1.6 Verify that all hazardous energy sources to the equipment/system have been removed and isolated.

*NOTE: Verification can be accomplished by attempting to restart the equipment/system, the use of test equipment, or testing for leaks from liquid materials, and visual inspection.*

CH3.1.1.7 Test equipment shall be verified as operating correctly if it is used to verify isolation.

*NOTE: See NFPA 70E Article 120.1 and 29 CFR pt. 1910.147 for more information for achieving a safe work condition.*

### **CH3.2 Verify At Completion of Service/Maintenance Activities**

CH3.2.1 Upon completion of servicing/maintenance activities, the authorized employee shall:

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 26 of 37</b>

CH3.2.1.1 Ensure that non-essential items are removed from the machine and the immediate area around the machine, and that the equipment/system components are operationally intact.

CH3.2.1.2 Ensure all personnel are removed from the area or positioned safely prior to restart.

CH3.2.1.3 Verify all controls are in neutral or correct restart positions.

CH3.2.1.4 Remove the energy-control devices and notify the affected employees the equipment/system is ready to be re-energized.

*NOTE: In cases where the authorized employee who applied the energy-control device is not available to remove it, that energy-control device may be removed with the approval from the authorized employee's supervision and organization's designated safety representative. This removal is not considered an emergency removal described in Chapter 4 of this MWI.*

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 27 of 37</b>

**CHAPTER 4**  
**Emergency Removal of Energy-Control Devices**  
**When the Employee that Installed the Energy-Control is Absent**

CH4.1 Removal of energy-control devices shall be limited to the employee who applied the energy-control devices unless the authorized employee who applied the energy-control device is not available to remove the device when it is needed to be removed.

CH4.2 The energy-control device shall be permitted to be removed by the authorized employee's supervisor or designee provided the following steps are completed:

CH4.2.1 The supervisor of the employee that placed the energy-control devices shall:

CH4.2.1.1 Verify that the level of safety is not being jeopardized in any way during this process.

*NOTE: Contact the Center's Safety Office for authorization or assistance as needed.*

CH4.2.1.2 Verify the authorized employee who applied the energy-control device is not available to remove the device.

CH4.2.1.3 Make a reasonable effort to contact the authorized employee to inform them that the energy-control device is planned to be removed and get a verbal clearance from the authorized employee.

CH4.2.1.4 If contact is not made, ensure that the authorized employee is informed of any actions taken prior to the employee's resuming work on the affected equipment/system.

CH4.2.1.5 Perform a walk-down of the affected equipment/system and thoroughly inspect the worksite to ensure the planned work has been accomplished and safe re-energization is possible.

CH4.2.1.6 Check the equipment/system and the adjacent area to ensure all potentially hazardous items are removed and equipment/system is ready for re-energization.

CH4.2.1.7 Verify the controls of equipment/system are positioned where it can be safely re-energized.

CH4.2.1.8 Verify that when the equipment/system is re-energized that everyone is in a safe area and removed from any potential impact that may result from the equipment/system re-energization.

CH4.2.2 Affected employees are notified that the equipment/system energy-control devices have been removed and the equipment/system is functional.

CH4.3 The supervisor directly responsible for the equipment/system shall ensure the equipment/system is safe to re-energize following the steps listed in CH4.2.1 in situations where it cannot be determined what employee or organization placed the energy-control devices on the equipment/system.

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 28 of 37</b>

## **APPENDIX A DEFINITIONS**

Administrative-Control Locks/Tags (as applied to this MWI) Locks and tags that may be attached by the operator to the equipment/system energy-control device to ensure the equipment/system configuration or position do not change. These locks are sometimes referred to as personal locks. The terms “administrative-control lock” and “personal lock” are used interchangeably at MSFC.

Affected Employee An employee whose job requires them to operate or use equipment/system on which service/maintenance is being performed under an energy-control process such as LO/TO, or whose job requires them to work in an area where such service/maintenance work is being performed.

Authorized Employee An employee who locks out or tags out an equipment/system in order to perform service/maintenance on that equipment/system. An affected employee can become an authorized employee when that employee’s duties include performing service/maintenance covered in this MWI, and they have received the training and certification identified in Chapter 1 of this MWI.

Capable of Being Locked An energy-isolating mechanism is capable of being locked if it has a hasp or other means of attachment to which, or through which, a lock can be affixed or has a locking mechanism built into it. Other energy-isolating mechanisms are capable of being locked out if lockout can be achieved without the need to dismantle, rebuild, or replace the energy-isolating mechanism or permanently alter its energy-control capability.

Center NASA owned property that has been designated as a NASA Center. In this MWI the Center is MSFC or MAF.

Center’s Facilities Management Office (FMO) The Center Office/Department/Branch that provides insight, oversight and coordination of facility operation and maintenance-related issues with internal and external organizations to ensure compliance is maintained with all applicable facility-related Executive Orders, Federal, State, local, NASA and Center regulations in accordance with NPR 8831.2. At MSFC these functions are performed by the Office of Center Operations/FMO/AS20. At MAF these functions are performed by the MAF Operations Office/AS60 and the SACOM FMOD who ensure all facility-related day-to-day functions identified in this MWI for FMO are performed at MAF.

Center’s Safety Office The Center Office/Department/Branch that provides insight, oversight and coordination of safety-related issues with internal and external organizations to ensure compliance is maintained with all applicable safety-related Executive Orders, federal, state, local, NASA and Center regulations in accordance with in NPR 8715.1 and NPR 8715.3. At MSFC these functions are performed by the SMA Directorate/ISB/QD12. At MAF these functions are performed by the MAF SMA Manager/QD12 and the SACOM Safety and Health

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 29 of 37</b>

Services who ensure all safety-related day-to-day functions identified in this MWI for SMA and ISB are performed at MAF.

CERTRAK The MSFC SMA software database system used for employee certification records. CERTRAK is accessed through MSFC’s “Inside Marshall,” select “Organizational Websites,” locate “Safety and Mission Assurance Directorate,” select “Safety, Health and Environmental,” select “Safety Tools and Apps.”

Complex Equipment/System Equipment/systems that have multiple types or locations of energy sources or have a specific sequence of steps necessary to safely shut down and start-up or have the possibility to accumulate stored energy.

Construction Work (as applied to this MWI) Activities involved in building, assembling, altering, and repairing a structure or infrastructure.

Danger Zone/Point of Operation An area on the equipment/system where work is performed or where potential danger can exist during an operating cycle.

Energized Connected to an energy source or containing residual or stored energy.

Energy-Control Device The placement of a device on an energy-isolating mechanism that ensures the energy-isolating mechanism and the equipment/system being controlled cannot be operated until the device is removed. Energy-control devices are installed in accordance with an established energy-control program. The term energy-control device is used interchangeably with lockout device or tagout device.

Energy-Control Procedure A procedure developed, documented, and utilized to control potentially-hazardous energy when employees are engaged in service/maintenance activities defined in the scope of this document. This procedure is often times referred to as a LO/TO procedure.

Energy-Control Program A program consisting of energy-control procedures, employee training, and annual inspections/reviews to ensure that, before any employee performs any service/maintenance activity on equipment/systems, it is isolated from the energy source, rendered inoperative, and placed in a safe-work condition to prevent the unexpected energizing, startup, or release of stored energy that could occur and cause injury. This program is often times referred to as a LO/TO program.

Energy-Isolating Mechanism A mechanical device that physically prevents the transmission or release of energy, such as a circuit breaker, disconnect switch or valve. Push buttons, selector switches, programmable logic controllers or other control circuit type devices are not considered energy-isolating mechanisms.

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 30 of 37</b>

Energy Source Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal or other stored energy.

Exclusive Control (as applied to energy-control) When the authorized employee has the authority to and is continuously in a position to prevent (exclude) other individuals from re-energizing the equipment/system during service/maintenance activities. An example is when the employee has physical possession of the plug for cord and plug-connected equipment/systems. OSHA does not consider a switch, breaker, valve, etc., turned “off” in the area where the work is actually being performed as being under the employee’s exclusive control.

Group Lockout A means by which each authorized employee performing servicing and/or maintenance exercises their control over the associated hazardous energy by attaching their personal LO or TO device to a group LO/TO mechanism. It consists of personal LO/TO devices, group LO/TO devices/mechanics, and equipment LO/TO devices.

Group Lockout/Tagout (LO/TO) Device Any device that, when used as part of a group LO/TO system, permits each individual employee to use their personal LO/TO devices to physically secure energy-isolating mechanism(s) during the servicing or maintenance work. Examples include, but are not limited to, group lockout hasps, lockboxes (containing keys or tabs from equipment locks or job tags) or similar group mechanisms.

Hazardous Energy An energy, including mechanical (e.g., power transmission apparatus, counterbalances, springs, pressure, or gravity), pneumatic, hydraulic, electrical, chemical, nuclear, and thermal (e.g., high or low temperature) energy that could cause injury to employees. Danger is only present when energy can be released in quantities or at rates that could injure employees.

Hazardous Energy Control Procedure (HECP) A machine-specific or system-specific procedure identifying all known energy sources present on a particular piece of equipment or system. The procedure indicates the location of energy isolation points and the sequence of steps to be taken to properly lock out the equipment. If certain normal production operations require alternative means of protection to be taken prior to work, both the normal production operation activities and the alternative means of protection to be utilized is documented on the HECP.

Lockout (LO) Device A device that uses a positive means, such as a lock, blank flange, bolted slip flange and blind, chain, blocks, line valve, wedges, key blocks, adapter pins, and/or self-locking fasteners or similar devices that are used independently or as a combination, to lock and hold an energy-isolating mechanism in a safe position to prevent it from being energized. These devices are also referred to as energy-control devices.

Organization For purposes of this MWI, the term organization refers to all MSFC and MAF directorates, offices, and onsite/offsite contractors that have the responsibility for the employees performing energy-control activities, or request performance of work on their equipment/system that require energy-control activities.

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 31 of 37</b>

Offsite Contractors Contractors that are physically located off Center and do not have a designated office area/trailer located on Center. These contractors are temporarily on Center to install equipment/systems, perform maintenance on equipment/systems/structures and in some cases construction/demolition and similar activities.

Other Employee(s) Employee(s) who may be in the area where energy-control procedures may be used.

Personal Locks/Tags Locks and tags that may be attached by the operator to the equipment/system energy-control device to prevent the equipment/system from being operated by unauthorized personnel and are also used during group LO/TO activities. These locks are sometimes referred to as administrative-control locks. The term administrative-control lock and personal lock are used interchangeably.

Safe-Work Condition (as applied to energy-control) A safe-work condition is achieved by (1) disconnecting or isolating the equipment/system from its energy source; (2) physically verifying the equipment/system is disconnected or isolated; (3) installing energy-control devices on the equipment/system energy isolating mechanism to prevent the equipment or system from being energized, restarted, or capable of releasing hazardous energy; and (4) verifying the equipment/system will not restart after the energy-control devices have been installed.

Safe-Work Practices (as applied to energy-control) Practices developed in either written text or pictorials, or a combination of both that contain the “do’s and don’ts” of common work practices addressing the specific company work practices for a certain activity and are normally found in owner’s manuals, industry guides, sample manuals, and others.

Safety Critical A term used to describe a condition, event, operation, process, equipment, or system that could cause or lead to severe injury, major damage, or mission failure if performed or built improperly, or allowed to remain uncorrected.

Service/Maintenance. Workplace activities such as assembling, constructing, installing, setting up, adjusting, inspecting, modifying, lubricating, cleaning, unjamming, and making adjustments or tool changes to equipment/systems where the employee may be exposed to the unexpected energization, startup, or release of hazardous energy.

Simple Equipment/System Equipment/systems considered as simple include all of the following: (1) The equipment/system has no potential for stored or residual energy or reaccumulation of stored energy after shut down which could endanger employees; (2) the equipment/system has a single energy source which can be readily identified and isolated; (3) the isolation and locking out of that energy source will completely de-energize and deactivate the equipment/system; (4) the equipment/system is isolated from that energy source and locked out during servicing or maintenance; (5) a single lockout device will achieve a locked-out condition; (6) the lockout device is under the exclusive control of the authorized employee performing the servicing or maintenance; (7) the servicing or maintenance does not create hazards for other

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 32 of 37</b>

employees; and (8) the employer, in utilizing this exception, has had no accidents involving the unexpected activation or re-energization of the equipment/system during servicing or maintenance.

Stored/Potential/Residual Energy Energy stored in a body or in a system due to its position in a force field or due to its configuration.

Tagout (TO) Device A prominent warning device, such as a tag and a means of attachment that can be securely fastened to an energy-isolating mechanism in accordance with an established program to indicate that the energy-isolating mechanism and the equipment/system being controlled cannot be operated until the tagout device is removed.

Tenant An organization/company that is located on NASA/MSFC-owned or controlled property that has been granted occupancy of an area through a legal Space Act Agreement or grant. A tenant may or may not be directly associated with NASA/MSFC/MAF related work.

Work Authorization Document (WAD) A control document that authorizes and outlines the scope, purposes, authorization, rules, requirements, techniques, and specific steps to accomplish a work task. Examples include, but are not limited to, process plans, test preparation sheet, discrepancy and correction report, troubleshooting and inspection report, safe plan of action, and engineering change request.

Zero-Energy State A term that applies to equipment/system status where all hazardous energy sources have been disconnected and secured and all internal energy sources have been relieved or restrained in a safe manner.

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 33 of 37</b>

## **APPENDIX B ACROYNMS**

CERTRAK – Certification Tracking Database

CFR – Code of Federal Regulations

CO – Contracting Officer

COR – Contracting Officer’s Representative

CPL – OSHA Compliance Instruction

FMO – Facilities Management Office

FMOD – Facilities Management Office Department (applicable to MAF)

FWR – Facility Work Request

HECP – Hazardous Energy Control Procedure (applicable to MAF)

ISB – Industrial Safety Branch

LO/TO – Lockout/Tagout

MAF – Michoud Assembly Facility

MIDL – Marshall integrated Document Library

MPR – Marshall Procedural Requirements

MSFC – Marshall Space Flight Center

MWI – Marshall Work Instructions

NFPA – National Fire Protection Association

NPR – NASA Procedural Requirements

NRRS – NASA Records Retention Schedules

OSHA – Occupational Safety and Health Administration

Pt – Part

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 34 of 37</b>

QD – MSFC SMA Directorate Code

SACOM – Synergy Achieving Consolidated Operations and Maintenance

SMA – Safety and Mission Assurance

SATERN – System for Administration, Training, and Educational Resources for NASA

SHE – Safety, Health, and Environmental

TPS – Test Preparation Sheet

V – Volts

WAD – Work Authorization Document

**Marshall Work Instruction  
QD01**

<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 35 of 37</b>

**APPENDIX C  
VERIFICATION MATRIX**

Section	Brief Description	Verification			Comments
		Inspect	Document	Test	
5.1	MSFC energy-control program	x	x		
5.2	Energy-Control Procedures		x		
5.3	Energy-control devices	x			
5.4	Center standardized energy-control devices	x			
5.5	Administrative-control locks and tags	x			
5.6	Energy-isolation mechanism not capable of being locked	x			
5.7	Group energy-control process	x	x		
5.8	Work on flight hardware/systems	x			
5.9	Shift or personnel changes	x			
5.10	Offsite contractors perform work onsite	x	x		
5.11	Annual review of energy-control procedures	x	x		
5.12	Temporary removal of energy-control devices for testing or positioning	x			
5.13	Disciplinary actions		x		
5.14	Emergency situations requiring removal of energy-control devices	x			
5.15	Electrical Panels Locked to Prevent Unauthorized Access		x		
CH1	Training and Certification		x		
CH2	MSFC Standardized Energy-Control Devices	x			
CH3	Verification of Isolation From Energy Sources	x			
CH4	Emergency removal of energy-control devices when employee that installed the energy-control is absent	x			

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 36 of 37</b>

**APPENDIX D  
RECORDS**

<b>RECORD</b>	<b>REPOSITORY</b>	<b>RETENTION</b>
Annual inspection/review of written energy-control procedures (MSFC Form 4287 or equivalent) and/or organizational standard energy-control safe-work practices	Maintained by the organization that performs the energy-control procedure	NRRS 1/26.5/B: Destroy when 5 years old
LO/TO Training	At MSFC per MPR 3410.1  At MAF, the MSFOC Training Department maintains personnel training	Per MPR 3410.1
Authorized employee certification	At MSFC Maintained by SMA in CERTRAK  At MAF, the MSFOC Training Department maintains personnel training records reflecting LOTO certification	Per MWI 3410.1
Written energy-control procedures and organizational standard energy-control safe-work practices	Maintained by the organization that performs the energy-control procedure	NRRS 1/72/B/2: Destroy when superseded or obsolete

<b>Marshall Work Instruction QD01</b>		
<b>Control of Hazardous Energy (Lockout/Tagout) Program</b>	<b>MWI 8715.2</b>	<b>Revision: L-1</b>
	<b>Date: January 27, 2017</b>	<b>Page 37 of 37</b>

## **APPENDIX E REFERENCES**

E.1 Occupational Safety and Health Administration (OSHA) Instruction CPL 02-00-147, The Control of Hazardous Energy – Enforcement Policy and Inspection Procedures (2.6 and 5.2.5.1)

E.2 Occupational Safety and Health Administration (OSHA) 3120, Control of Hazardous Energy Lockout/Tagout (5.2.5.2)

E.3 NASA Desk Guide for Table of Disciplinary Offenses and Penalties (5.13.1.1)

E.4 OSHA Standard Interpretation 10/29/1996 – Consultants performing lockout/tagout periodic inspections (5.11.4)

E.5 SHE 128, “MSFC Lockout/Tagout Training” (CH1.1.1)

E.6 MAF SHE 128, “MAF Lockout/Tagout Training” (CH1.1.2)