

The Role of the "Red Key" in the NTF Safety System

A. J. Lennox

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Introduction

The Review Committee which studied the document entitled "The NTF Interlock Box" requested more detailed information on the exact role of the red key labeled NTF Reset and Enable. This document is being written in response to that request. It should be considered an appendix to the earlier document and is best understood if one has already studied the earlier document including its Figures 1 and 2. As before, this is intended to give a basic understanding of how the system works. Detailed information of the type needed to build or repair a module is available on drawings to be specified later. The key plays two distinct roles. First, it is used to secure the NTF radiation areas. Second, it is used to turn on and control the ramp signals to the 58⁰ and 32⁰ magnet power supplies.

First Role: Secure NTF Radiation Areas

As is indicated in drawing 9080-EE-83187 the key is needed to start a delay circuit used in securing the treatment room and the gated-off area limiting access to the neutron production target. The target area is located in the lower linac gallery just outside the treatment room and is accessed only with a radiation safety officer present. The red key is needed to unlock the gate. When the beam is on, access to the treatment room is sealed in one of two ways: either the large, slowly moving air door is in place or the easier-to-handle poly door is closed. If the poly door is used a white key labeled "Air Door Override" is inserted in the Radiation Safety System Module located in the medical control room. Normally the poly door is used because it enables the technologists to enter the room quickly if the patient requires immediate attention. (Usually this happens when the patient faints or starts to vomit. To my knowledge there has never been a case where the technologists had to physically remove a patient because the beam failed to turn off). To secure the treatment room the technologists insert and turn the red key in a tumbler located in the treatment room. When a red LED turns on, they remove the key from the tumbler and then have 20 seconds to leave the room and close the poly door to secure the room. At this point the room is secure but the contactors in the power supplies are still open. The red key must be used in another way to close the contactors and ramp up the supplies.

Second Role: Turn On and Ramp the Power Supplies

When the neutron beam is not in use the power supplies are locked out. Before treatment the red key is used to unlock the padlocks on the circuit breaker so the AC power contactor can be energized. Then the DC power can be enabled remotely via the red key. A reference value for the D to A is set from a parameter page. (As of this writing the D to A cannot be set from the medical control room). Before the red key can be used to turn on the supplies all of the logic in level I of the Interlock Box must be satisfied. This includes entering a dose, resetting the medical microprocessor and setting the scaler and timer backup systems, none of which can be done from the main control room. If level I is made up, the red key can be used to turn on the supplies from either the main control room or the medical control room. In the MCR there is a tumbler in the NTF Status and Control Module. In the medical control room there is a tumbler in a yellow panel labeled CTF Beam Control. Turning the red key in either tumbler closes a 4 pole switch, S1a, S1b, S1c, and S1d. S1c is the switch in level I of the Interlock Box. S1b is the switch in the NTF System Ready line after level III of the Interlock Box. S1a closes a circuit in the Contactor Control Module and energizes the time delayed relays used to remotely reset the 58° and 32° power supply interlock and to close the contactors in the 58° and 32° power supplies. S1d is part of the circuit used to request beam by simultaneously pressing the two red push buttons on the CTF Beam Control Panel. The NTF Interlock Box ignores the "Medical Beam Request" if S1d is open. Details of the CTF Beam Control Panel are included in drawing 9030-ED-83419. The Contactor Controller Module is detailed in drawing 9050-EC-83424 and the 58° Power Supply External Interlock Module is shown in drawing 9050-ED-83404.

Summary

The red key is used to secure areas for the radiation safety system. It is used in the NTF Interlock Box to complete circuits which close power supply contactors and issue the Ramp Enable, Medical Beam Request and NTF System Ready signals. If it is removed while the power supplies are on, the reference voltage is set to zero but the power supply contactors do not open. The only way to remotely open these contactors is through the Radiation Safety System Module. There is only one "Red Key". If a technologist is carrying that key he or she can be sure no one else can turn on the neutron beam, just as a person making a controlled access to the main ring enclosure depends on his key to keep the beam off.

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First Role: Secure NTF Radiation Areas

As is indicated in drawing - - the key is used to start a delay circuit used in securing the treatment room and the gated-off area limiting access to the neutron production target.

The target area is located in the lower linac gallery just outside the treatment room and is accessed only with a radiation safety officer present. The red key is needed to unlock the gate. When the beam is on, access to the treatment room is sealed in one of two ways: either the large, slowly moving air door is in place or the easier-to-handle poly door is closed. If the poly door is used a white key labeled "Air Door Override" is inserted in the Radiation Safety System Module located in the medical control room. Normally the poly door is used because it enables the technologists to enter the room quickly if the patient requires immediate attention. (Usually this happens when the patient faints or starts to vomit. To my knowledge there has never been a case where the technologists had to physically remove a patient because the beam failed to turn off). To secure the treatment room the technologists insert and turn the red key in a tumbler located in the treatment room. When a red LED turns on, they remove the key from the tumbler and then have 20 seconds to leave the room and close the poly door to secure the room. At this point the room is secure but the contactors in the power supplies are still open. The red key must be used in another way to close the contactors and ramp up the supplies.

Second Role: Turn On and Ramp the Power Supplies

When the neutron beam is not in use the power supplies are locked out. Before treatment the red key is used to unlock the padlocks so the AC power switches can be enabled. Then the DC power is enabled manually. A reference value for the D to A is set from a parameter page. (As of this writing the D to A cannot be set from the medical control room). Before the red key can be used to turn on the supplies all of the logic in level I of the Interlock Box must be satisfied. This includes entering a dose, resetting the medical microprocessor and setting the scaler and timer backup systems, none of which can be done from the main control room. If level I is made up, the red key can be used to turn on the supplies from either the main control room or the medical control room. In the MCR there is a tumbler in the NTF Status and Control Module. In the medical control room there is a tumbler in a yellow module labeled CTF Beam Interlock Box. Turning the red key in either tumbler closes a 4 pole switch, S1a, S1b, S1c, and S1d. S1b is the switch in level I of the Interlock Box. S1c is the switch in the NTF System Ready line after level III of the Interlock Box, S1a closes a circuit in the Contactor Control Module and energizes the time delayed relays used to remotely reset the 580 power supply interlock and to close the contactors in the 580 and 320 power supplies. S1d is part of the circuit used to request beam by simultaneously pressing the two

red push buttons on the CTF Beam Interlock Box. The NTF Interlock Box ignores the "Medical Beam Request" if S1d is open. Details of the CTF Beam Interlock Box are in drawing - - . The Contactor Control Modules are detailed in drawing - - and the 580 Power Supply Interlock Module is shown in drawing - - .

Summary

The red key is used to secure areas for the radiation safety system. It is used to close switches in the NTF Interlock Box to close power supply contactors and issue the Ramp Enable, Medical Beam Request and NTF System Ready signals. If it is removed while the power supplies are on, the reference voltage is set to zero but the power supply contactors do not open. The only way to remotely open these contactors is through the Radiation Safety System Module. There is only one "Red Key". If a technologist is carrying that key he or she can be sure no one else can turn on the neutron beam, just as a person making a controlled access to the main ring enclosure depends on his key to keep the beam off.