INL/MIS-22-69603-Revision-0

Alabama A&M University Senior Project

December 2022

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Changing the World's Energy Future

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Core Clamping Upgrades

Battelle Energy Alliance manages INL for the
U.S. Department of Energy's Office of Nuclear Energy

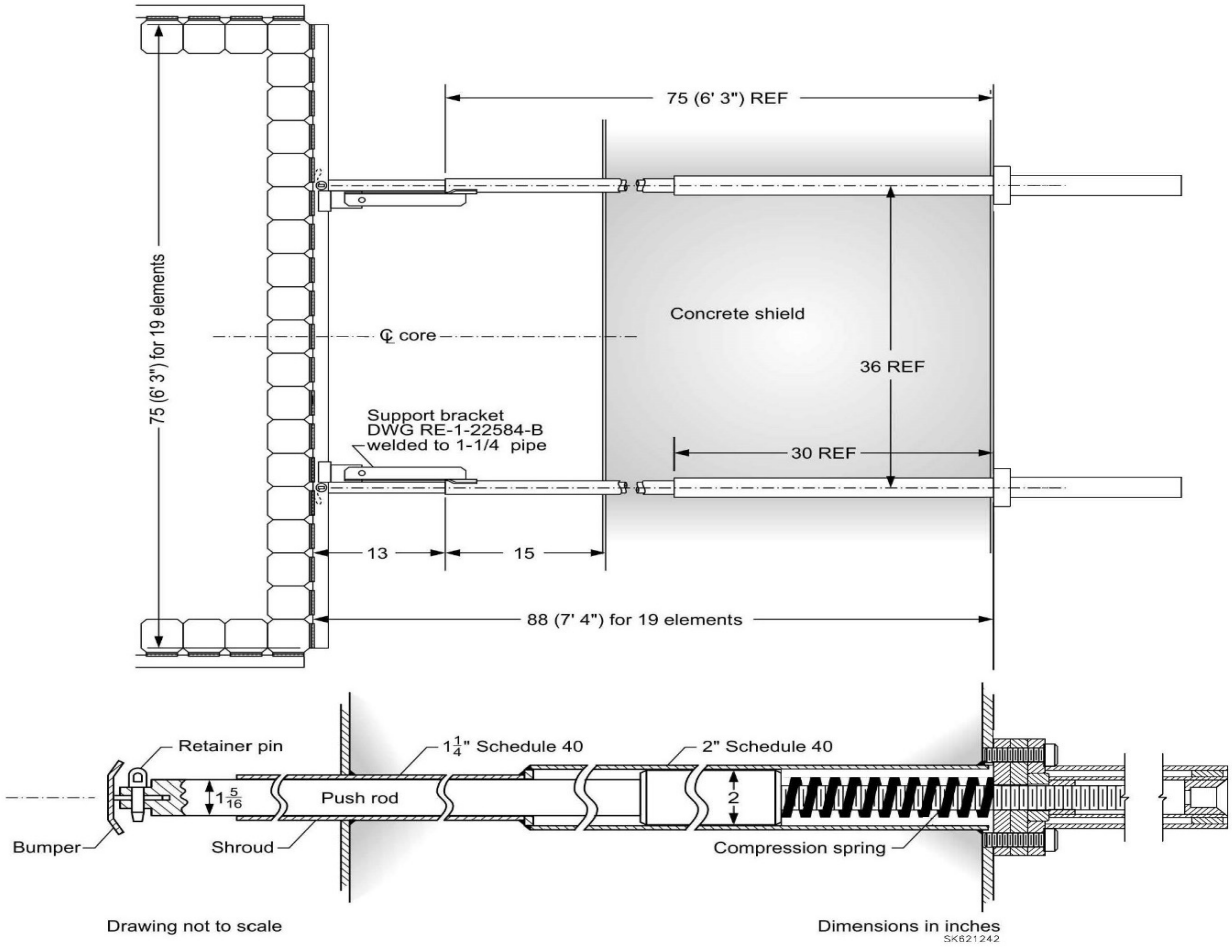
Idaho National Laboratory

Overview of System and Upgrades

Core Clamping System

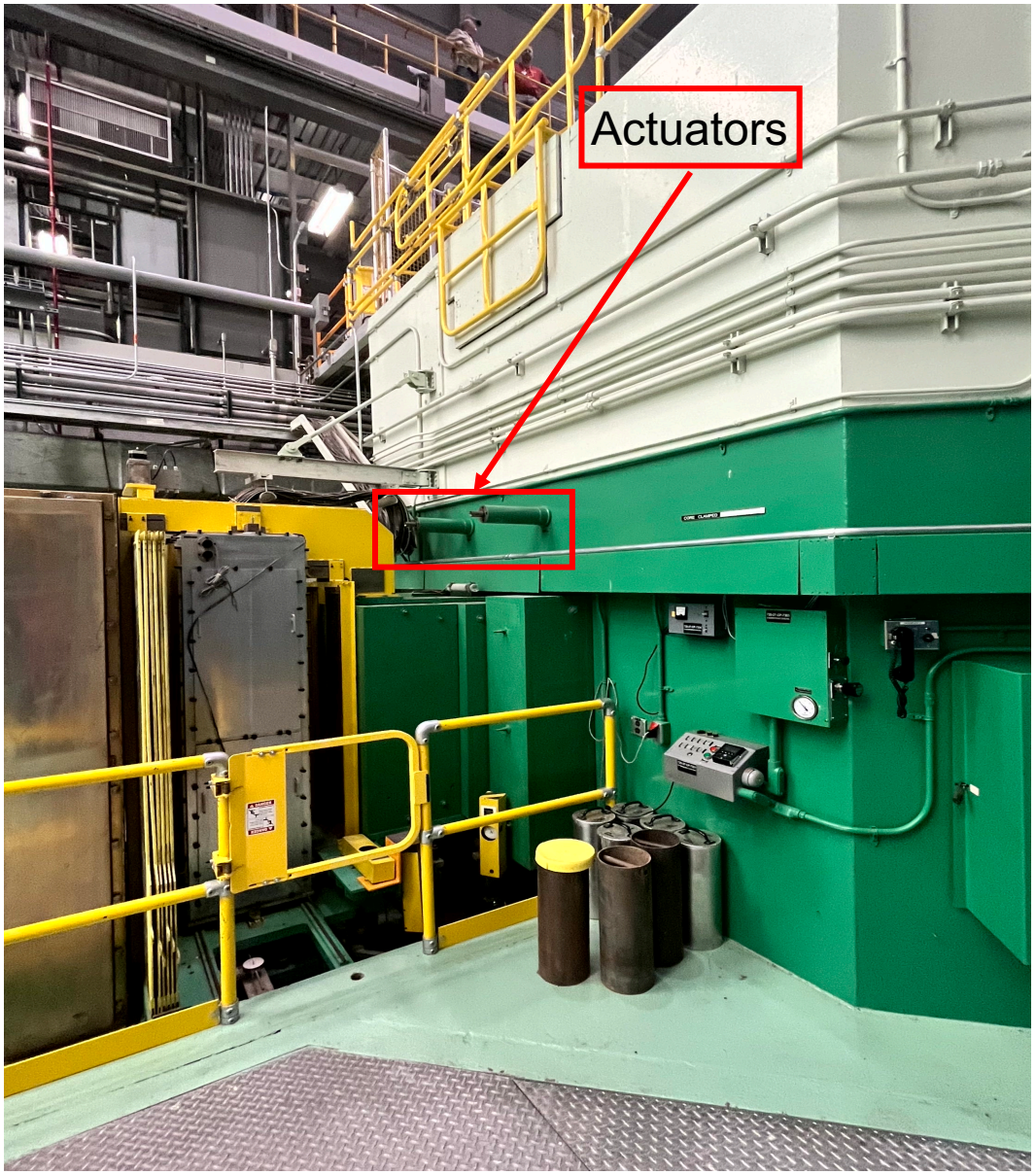
- Four horizontally mounted clamping bars utilized to ensure alignment of fuel assemblies within the core.
- Each clamping bar is actuated by two push rods that operate through horizontal penetrations in the concrete shield.
- North and East clamping bars are flanged and bolted into position. (Operated to a hard stop)
- South and West clamping bars are spring loaded to ensure even, consistent force on fuel assemblies
- Currently operated using ½ inch hex/Allen socket welded to a long reach tool and socket wrench (81 inches)

TREAT Core Clamping Bars



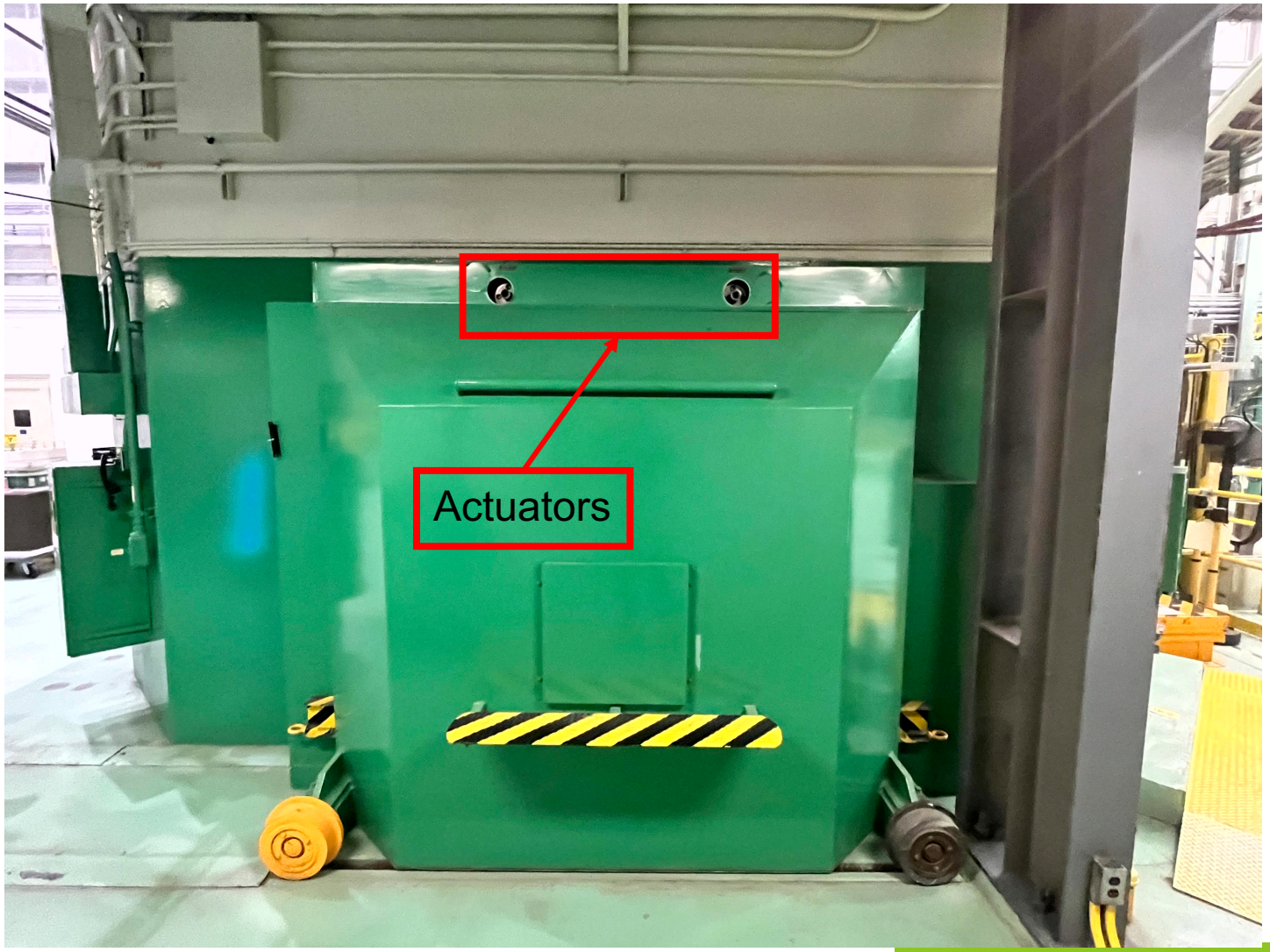
North Face

North Face

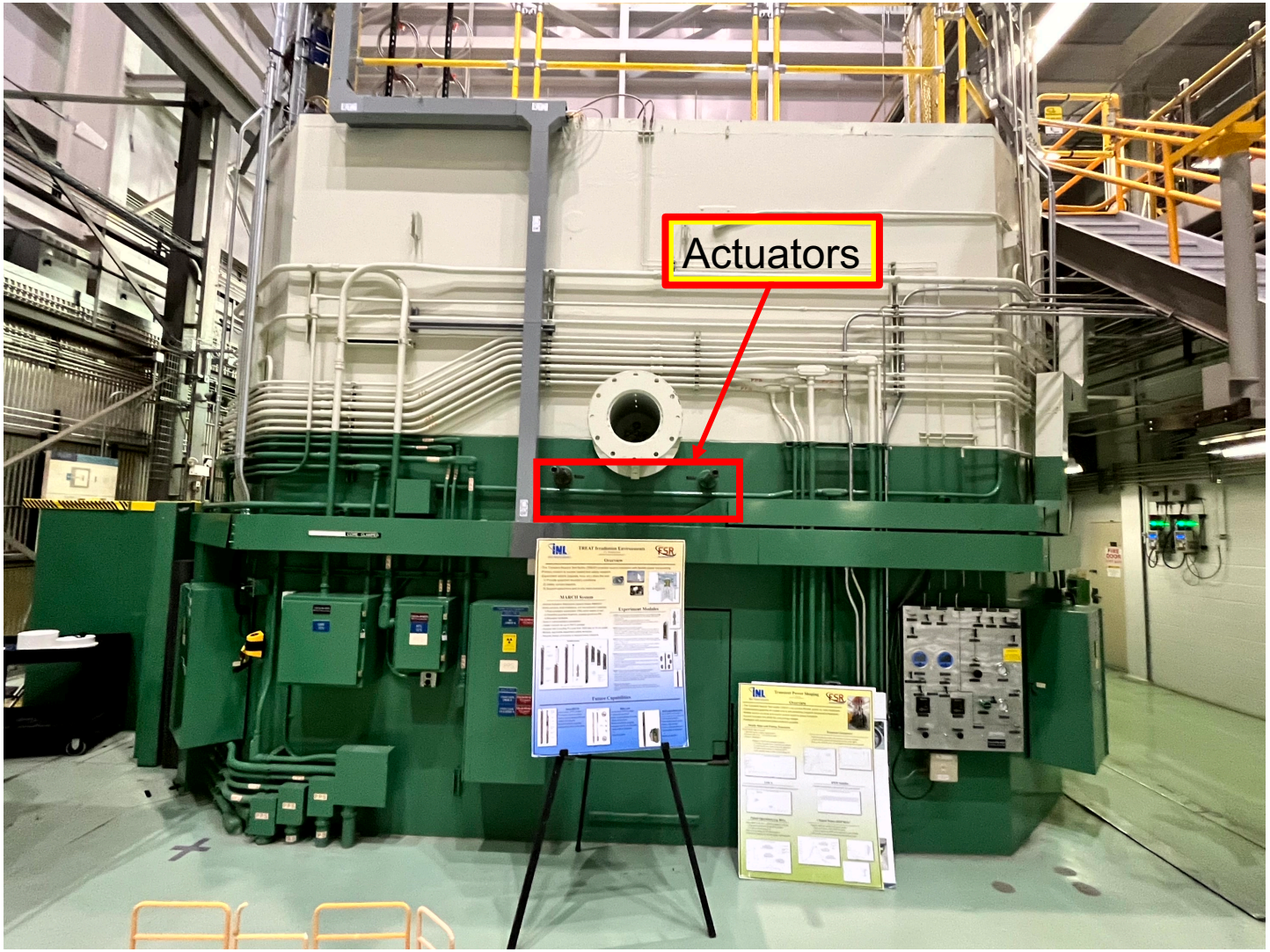


North Face (NE Corner)

East Face



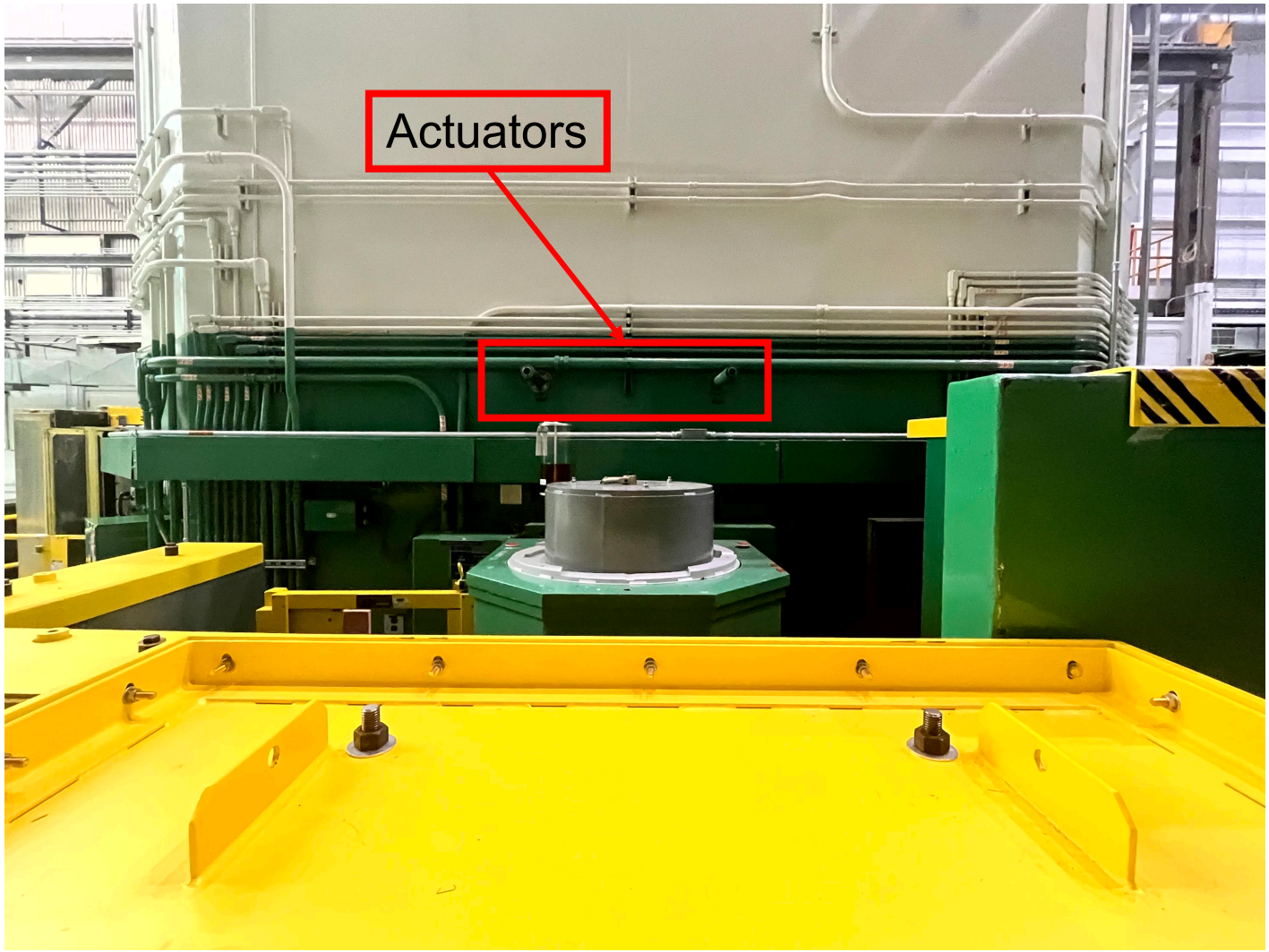
South Face



South Face (SW Corner)

SW Corner

West Face



West Face (NW Corner)

Flash Radiography Shielding

1 inch base plate

Raceway to Shielding

Current Tool

- ½ inch hex/allen socket welded to an 81 inch long reach tool and socket wrench

General Operation

- Sequencing
  - During UNCLAMPING the spring loaded bumpers must be pulled away first
  - During CLAMPING spring loaded bumpers must be applied last, after hard stop bumpers
- North and East Clamps
  - Clamping- Approximately 8 turns CCW to hard stop
  - Unclamping - ~8 turns clockwise to hard stop

General Operation

- South and West Clamps
  - Clamping
    - TURN the operator screws counterclockwise until the screw head just starts to move out of the outer tube (approximately 4 to 5 turns).
    - TURN operator screw counterclockwise another 4.5 turns.
    - VERIFY the operator screw head extends 3/8 to 5/8 in. beyond the outside tube.

General Operation

- South and West Clamps
  - Unclamping
    - TURN the operator screws clockwise until the screw head pulls in flush with the outer tube (approximately 4 to 5 turns).
    - TURN operator screw clockwise another 4.5 turns.

Project Goal and Engineering Inputs

- Provide a means to operate the core clamps remotely utilizing flexible shaft systems and hand wheels or electronic openers with push buttons
- New operators shall be capable of the required torque to operate the clamps (20 ft-lbs)
- Shall provide a means for visual verification (remote or local) of clamp position
- Should attach to existing clamps with only minor modifications
- Shall have a backup method of operating the clamps in the event of remote operator failure
- Spring loaded bumpers shall be pulled away first and applied last

Options/Road Blocks

- Limited Unistrut available that is currently mounted to the reactor
- New mounting onto the core structure is not an option.
- Cable tray/Raceway is available to run flexible shaft or wiring
- Limited space surround the reactor for mount to the floor
- Cannot obstruct hodoscope and radiography operations

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