

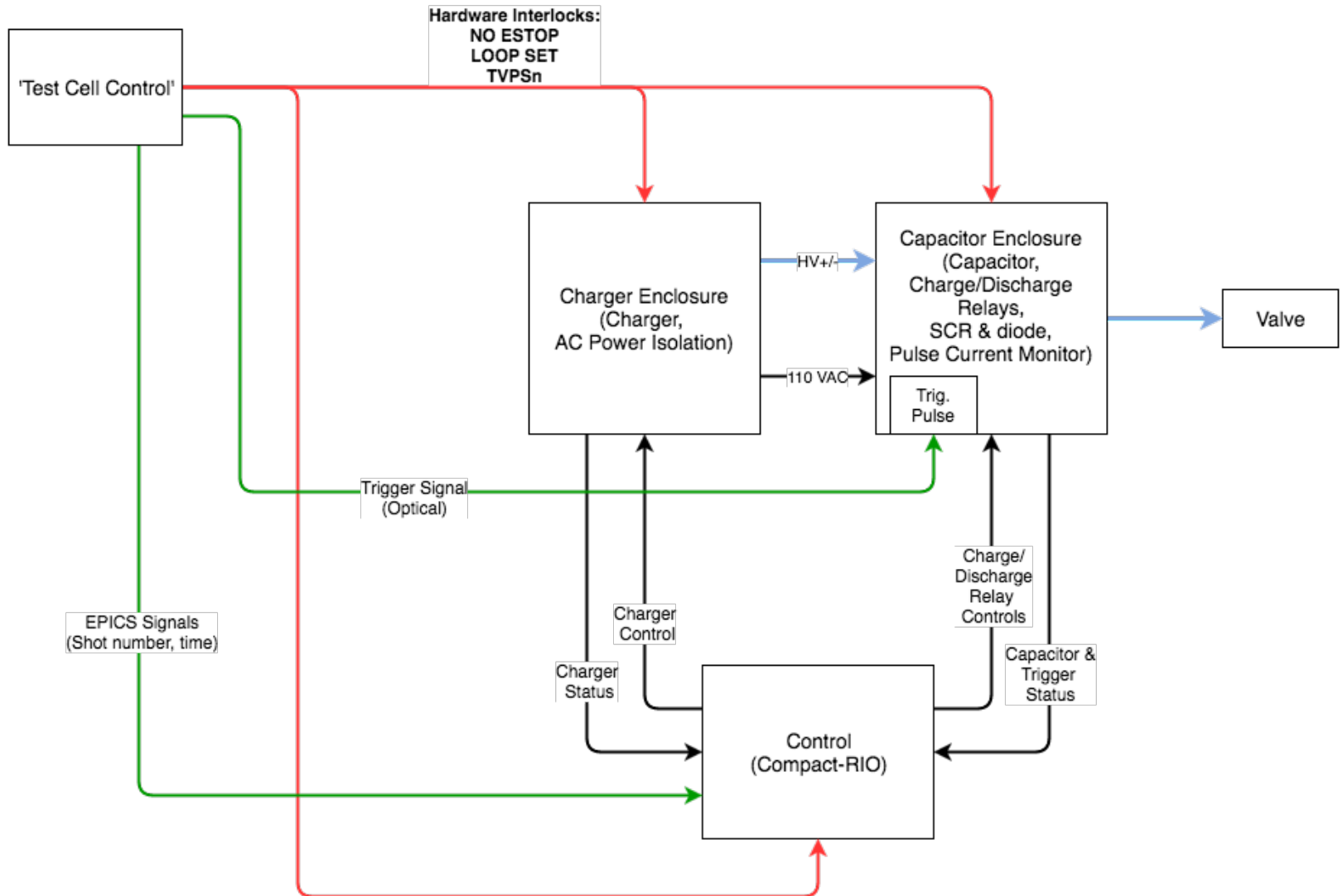
MGI ACC Review

May 5th 2016

Functional Overview

- MGI uses current pulse from discharging a capacitor to quickly open a valve
- Three separate systems
- Each system consists of three main sections
- Systems mounted in two equipment racks

MGI (Power) System Overview



Components

- Charger Enclosure
 - Capacitor Charger
 - AC Power isolation
- Capacitor Enclosure
 - Capacitor: 550uF, 1000V -> 275J
 - NC Discharge Relay
 - NO Charge Relay
 - Voltage & current sensors

Components (cont.)

- Control
 - NI Compact-RIO system (real-time controller)
 - Compact-RIO operated from remote GUI
 - Charges & discharges capacitor during NSTX-U shot following configurable time sequence
 - Monitors status of charger and capacitor
 - Records measurements
 - Observes all Hardware Interlock signals & reacts accordingly

Safety Signals

- Hardware Interlock Signals
 - NO ESTOP, LOOP SET
 - TVPS n
- Equipment Rack Door Switches
- Controller Related
 - EPICS signals: system powered down and cap. Discharged between shots
 - Controller Watchdog: forcing system into safe state if controller becomes unresponsive

Hardware Interlock Signal 'NO ESTOP'

- Monitored in all MGI components
- Inactive NO ESTOP:
 - Removes AC power from charger
 - Forces closure of discharge relay and capacitor discharge
 - Removes power from trigger circuit

Hardware Interlock Signal 'LOOP SET'

- Monitored in all MGI components
- Inactive LOOP SET:
 - Removes AC power from charger
 - Forces closure of discharge relay and capacitor discharge
 - Removes power from trigger circuit

Hardware Interlock Signal 'TVPS n'

- One signal for each MGI system
- Inactive TVPS:
 - Removes AC power from charger
 - Forces closure of discharge relay and capacitor discharge
 - Prevents triggering of SCR

Equipment Rack Door Switches

- Two door switches in each rack
- Ensure that rack doors are closed during operation
- Inactive Door Switches:
 - Prevent charging of capacitor
 - Remove power from trigger circuit

Control Software Safety

- MGI only functions if under operator control
- Controller monitors all HW interlock signals and reacts accordingly
- Controller has built-in HW watchdog to force system into safe state if controller software becomes unresponsive

Remote Control GUI

VI STOP

Current Shot Number 203173 **-1:30** Countdown (Seconds) -90

NSTX Shot Number 0

SOC Count 352

T-60 Count 343

of T-60 Events Seen 0

Timestamp of T-60 Event

Time of Previous T-60 Event

Shot Started
Shot Stalled
Shot Ended/Between Shots

loop counter 3

EPICS Interface Error
status code
source

MGI is Ready

Enabled

TVPS Permissive Granted

No Emergency Stop Present

Hardwired Interlock Loop is Set

Test Mode

Use Fake Clock Fake Clock 343

TVPS Permissive

T_EQ_0

MGL_TRIGGER

V_GPS 0.000

V_CAP 0

SOFTWARE E-STOP

MGI Shot Cycle Started

Writing config data to MDSplus

Dump Resistor Open

Charge Enable

Glassman Power Supply ON

High Voltage Enabled

Charge Request != 0

Charging Complete

Waiting for Shot

T=0 Trigger Detected

Writing data to MDSplus

Non-normal shutdown detected

MGI Shot Cycle Complete

Current State Ready

Config Written

Charging Voltage 1000 VOLTS

SECONDS

T0: Write Config data to MDSplus -55

T1: Open Dump Resistor -50

T2: Charge Enable -49

T3: Glassman Power Supply ON -48

T4: High Voltage Enable -47

P1: Set Charging Voltage -45

P2: Disable Charging Sequence -20

T5: Prepare for Shot and Discharge -15

T6: Close Dump Resistor 10

T7: Write Shot Data to MDSplus 15

Waveform Graph

Plot 0

Amplitude

Time

Waveform Graph 2

Plot 0

Amplitude

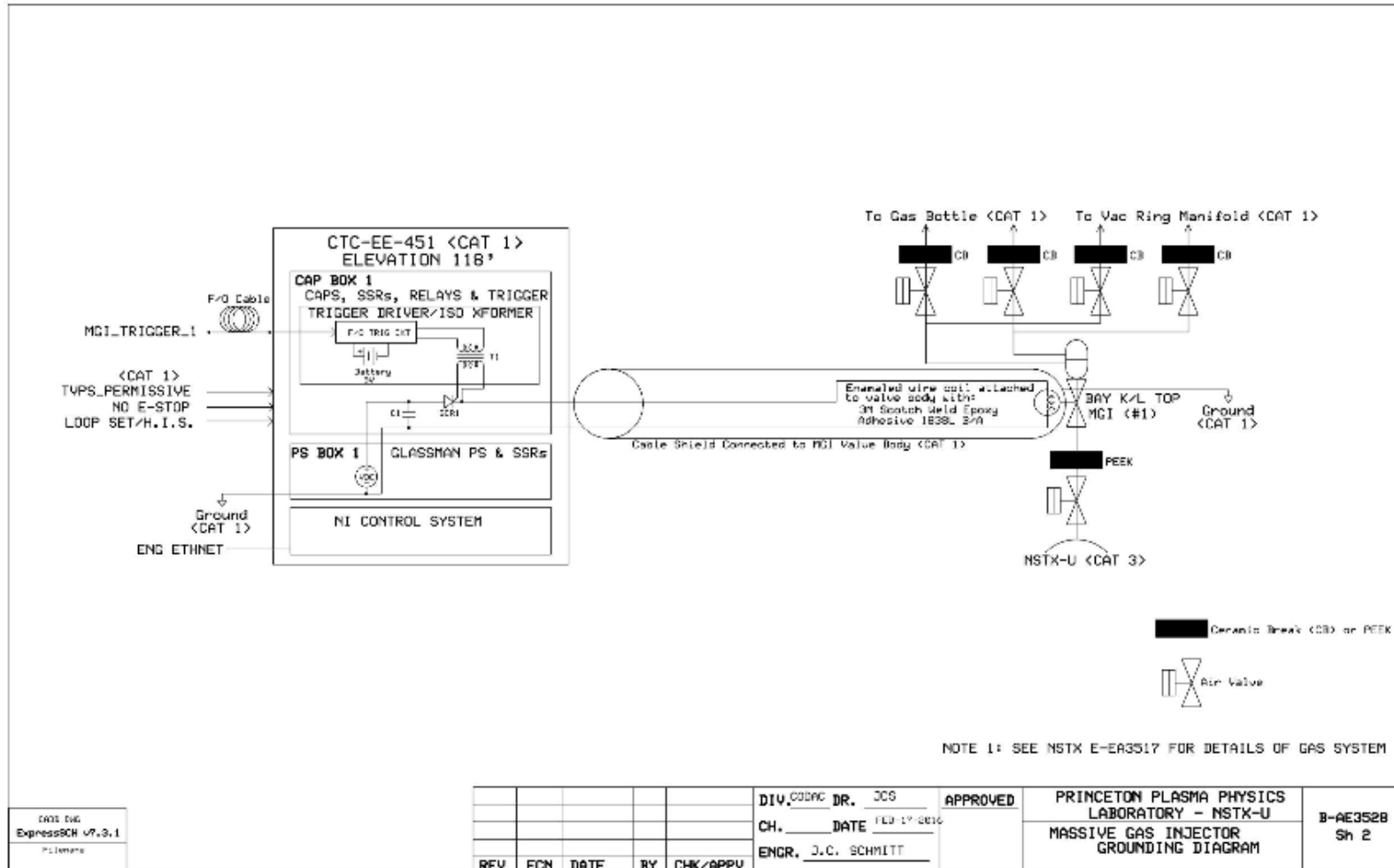
Time

Procedures

- Capacitor Safing Procedure
 - Process to ensure capacitor is discharged & grounded before any maintenance
- MGI PTP
 - Defines functional tests for a MGI system before installation
- MGI ISTP
 - Defines functional tests after installation, before operation
- MGI Operation Procedure

Additional Slides ...

Grounding Diagram



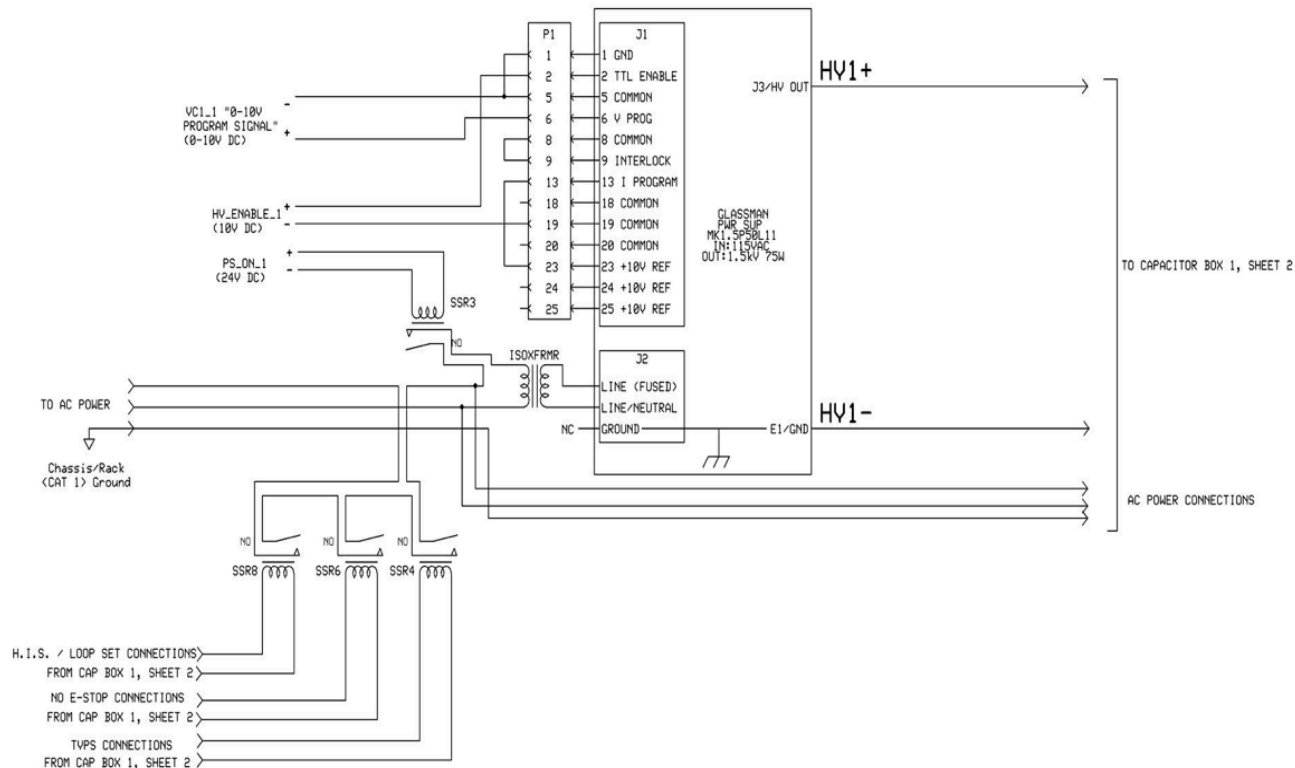
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PRINCETON PLASMA PHYSICS
LABORATORY - NSTX-U
MASSIVE GAS INJECTOR
GROUNDING DIAGRAM

B-AE3528
Sh 2



CADD DWG
ExpressSCH v7.3.1
Filename

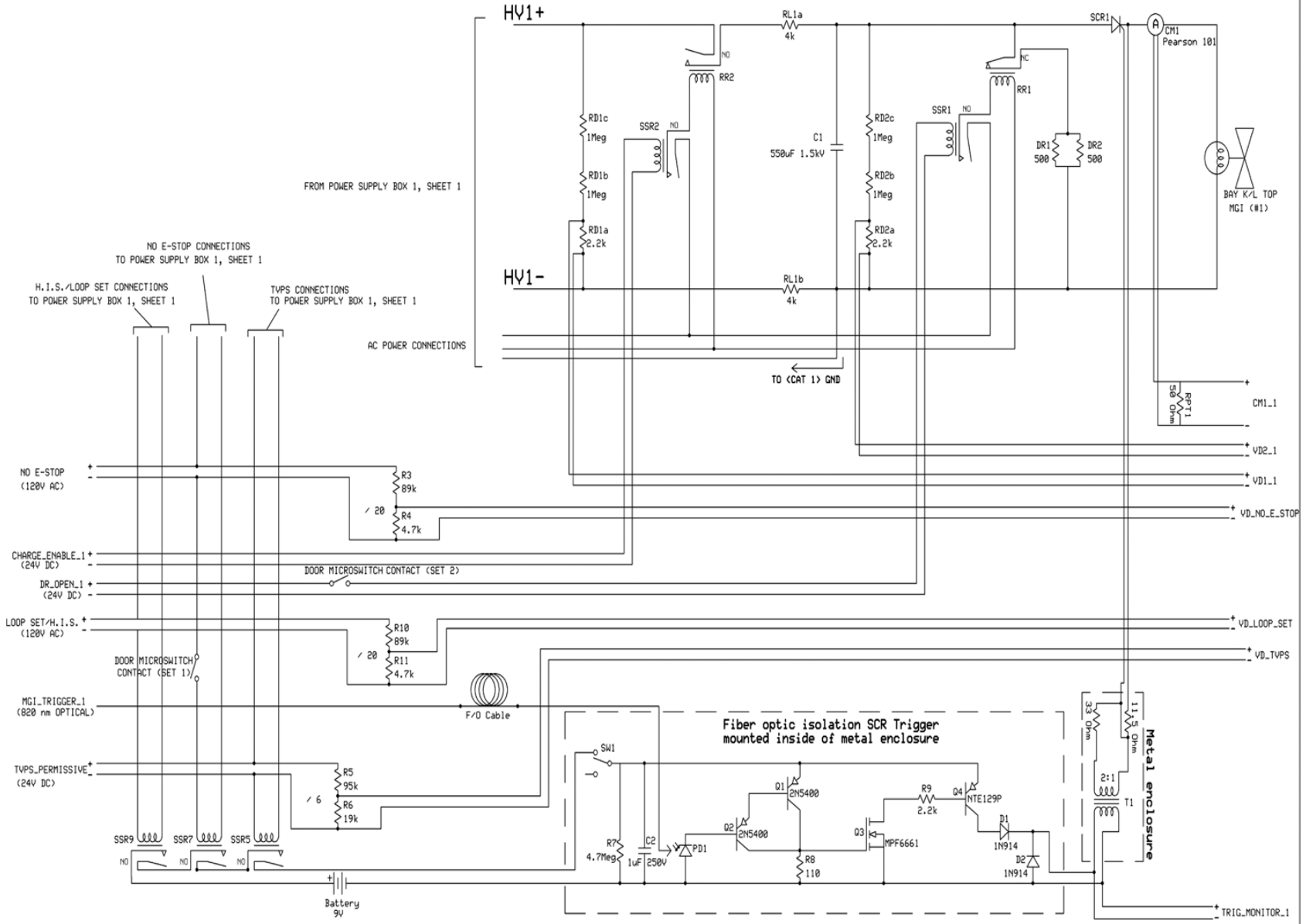
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PRINCETON PLASMA PHYSICS
LABORATORY - NSTX-U
MASSIVE GAS INJECTOR
POWER SUPPLY
SCHEMATIC DIAGRAM

B-AE3526
Sh 1



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