EVERSOURCE

Operations Project Authorization Form

Approved on January 19, 2023 EPAC

Link to Meeting Minutes

Project Title: CT Dist SS Workman's Grounds	**Project Number: CS00664**
Date Prepared: 01/09/2023	**Company: Eversource CT**
Organization: Electric System Operations	**Class(es) of Plant: Other**
Project Initiator: [redacted]	**Project Category: Control Center - General**
Managing Organization: Operations	**Schedule ID#: N/A**
Project Manager: [redacted]	**Project Type: Specific**
Project Sponsor: [redacted]	**Capital Investment part of original Op Plan: Yes**
Estimated in service date: May 2022 - Completed	**Emergency Related Request? No**
Eng./Constr. Resources Budgeted? Yes	**Facility Type (check all that apply):** ☐ **PTF** ☐ **non-PTF** ☐ **Distribution** ☒ **N/A (General Plant)**
Total Capital Request: $737K	**Authorization Type: Full Funding**

[1] Executive Summary

This project is seeking approval of full funding of $737K for a completed project to purchase new grounding tools to meet revised substation temporary protective grounding (TPG) practices and grounding equipment requirements based on updated fault current calculations and newly approved materials (See Reference 1).

The tool purchases and work were executed and completed in 2022 under the GXTD20 - 2020 CT D SS Capital Tool Annual Project. This Project Authorization Form (PAF) provides the documentation necessary to transfer the capital charges from three (3) of the GXTD20 work orders, GX200053 ($250K), GX200055 ($174K), GX200056 ($313K) to project number CS00664. The direct capital charges for each of the work orders have exceeded the $100K annual work order limit imposed in 2020 by APS-01. Work orders GX200053 and GX200056 were placed in service in May 2022, and work order GX200055 was placed in service in December 2021. Two other GXTD20 work orders GX200054 and GX200057, did not exceed the APS-01 limits.

This project authorization covers the purchase of grounding tools that include: 1) the new 55kA, 4/0 AWG Ground Cable assemblies; 2) the higher rated (47kA or 55kA) grounding material, including clamps, ball studs, breakaway bonds, and attachment points; 3) new green-coated vehicle ground cables; and 4) labor to assemble kits.

EVERSOURCE

[2] Project Costs Summary

Note: Dollar values are in thousands

Line item Category	Prior Authorized	Actuals to Date	2023	Total
1. ROW / Easements / Land Acquisition				
2. Environmental Approvals / Permits				
3. Outreach				
4. Siting Approvals / Permits				
5. Engineering / Design				
6. Materials (Eversource purchased)		$715		$715
7. Construction (incl matl's by contractors)		$9		$9
8. Testing / Commissioning				
9. Project Mgmt Team				
10. Removals				
11. Other				
12. Risks				
SUBTOTAL DIRECTS W/ RISKS	**$300**	**$724**		**$724**
13. Indirects/Overhead		$13		$13
14. AFUDC				
PROJECT TOTAL – BASELINE BUDGET	**$300**	**$737**		**$737**
15. Contingency				
TOTAL CAPITAL REQUEST	**$300**	**$737**		**$737**
16. Reimbursables/Customer Contribution				
PROJECT TOTAL (LESS REIMBURSABLES)	**$300**	**$737**		**$737**
O&M				
TOTAL REQUEST	**$300**	**$737**		**$737**

Cost Breakdown per WO

GXTD20	Amounts
GX200053 - Workman's Grounds Substation Const	**$250,246.84**
Directs	$247,167.54
Indirects	$3,079.30
GX200055 - Workman's Grounds Station Ops West	**$173,887.16**
Directs	$172,155.75
Indirects	$1,731.41
GX200056 - Workman's Grounds Station Ops Cent	**$312,696.91**
Directs	$304,573.88
Indirects	$8,123.03
Total	**$736,830.91**

Detail other costs, project risk items and their allocations:

Risk	Allocation
1. *N/A – Project is complete.*	$
2.	$
3.	$
4.	$
5.	$
Total	$0

Explain unique payment provisions, if applicable:

NA

Identify and detail any unique O&M impacts resulting from this project:

NA

[3] Technical Justification

Project Need, Objective and Justification

Project Need Statement

On October 8, 2019, there was an incident that occurred at [redacted], located in [redacted], which resulted in the need to update the Eversource substation temporary protective grounding (TPG) practices, grounding tool requirements based on updated fault current calculations and newly approved materials. See Reference 1. The success of the new TPG procedure implementation is dependent on providing the work force with the right tools, including the new higher rated ground cables and clamps, as well as new connection point attachments such as I-beam and pole band clamps.

Project Objectives

TPGs are installed to limit worksite exposure voltage (differences in electric potential) to a safe limit. With the updated, improved work practices, proper grounding materials are required to protect the worker against exposure to hazardous voltage levels under fault conditions. TPG tools must be properly designed and sized to carry the maximum available fault current for the required clearing time, in the event of inadvertent energization. TPGs must be able to withstand the magnitude and duration of the fault in terms of both thermal and mechanical energy delivered.

Business process and technical improvements have been made to increase employee safety by means of improved procedures and higher rated tools, as described above.

Project Scope

This project authorization is intended to cover the purchase of tools and labor to assemble the tool kits.

The tools include: 1) the new 55kA, 4/0 AWG ground cable assemblies; 2) the higher rated (47kA or 55kA) grounding material, including clamps, ball studs, breakaway bonds, and attachment points; and 3) new green-coated vehicle ground cables. See the table below for a summary of the material quantities purchased for this project.

Clamp/Accessory	GX200053	GX200055	GX200056	Total Quantity
5' H-rated 4/0 AWG, rated 55kA	57	90	90	237
10' H-rated 4/0 AWG, rated 55kA	57	90	90	237
12' H-rated 4/0 AWG, rated 55kA		90	90	180
15' H-rated 4/0 AWG, rated 55kA	57	90	90	237
25' - 4/0 AWG, Rated 47kA Green Vehicle Ground	94			94
50' - 4/0 AWG, Rated 47kA Green Vehicle Ground	20			20

Clamp/Accessory	GX200053	GX200055	GX200056	Total Quantity
C-type Clamp 0.75 inch	430	270	435	1,135
C-type Clamp 2.5 inch	123	99	99	321
C-type Clamp 3.5 inch		30		30
C-type Clamp 6 inch	74	72	96	242
C-type Clamp Split Combo 1.5 inch	202	162	318	682
Ball Stud 1 inch	97			97
Ball Socket Ground Clamp 1 inch		9	21	30
Flat Angle Clamp 3"x3"	36	54	54	144
Flat Angle Clamp 4"x4"	36	54	54	144
Vehicle Ball Socket Clamp 1 inch	48	12	12	72
Ferrules (for Vehicle Grounds)			500	500
Breakaway Bond c/w 2 x 2.5 inch Clamps	5		12	17
Grounding Cable 4/0 c/w Ferrules 15 Ft			27	27
Grounding Cable 4/0 c/w Ferrules 20 Ft			48	48
Grounding Cable 4/0 c/w Ferrules 25 Ft	20			20
I-Beam Clamp with Tee Handle	77			77

Background

On October 8, 2019, there was an incident that occurred at [redacted], which resulted in the need to update the Eversource substation TPG practices, material requirements based on updated fault current calculations and newly approved materials. The Incident Analysis (IA) identified gaps in the work procedures, materials identified and available for use, and increased the overall understanding and importance of correct grounding applications. This resulted in the following actions and results:

- T&D Standards, with the support from Protection and Control Engineering, re-calculated all Station/ bus section's maximum fault currents using the same methodology across the three (3) states in order to effectively protect the worker to maximum fault current exposure per OSHA.1910.269(n)(4)(i). The previous calculations referenced ASTM F855 Table 1 for symmetrical root mean square (rms) values. Based on industry best practices, Eversource now uses ASTM F855 Table 2, which was developed for testing with higher currents and higher X/R ratios using asymmetrical rms values. By modifying the design evaluation approach, it now allows Eversource to use higher rated "H" grade materials. The benefits of the 5H higher rated tools are that they provide a higher Ampacity rating (47kA vs. 43kA). Refer to reference 1.

- Based on industry experiences and best practices, it was also identified that there is a higher rated blue 4/0 AWG ground cable rated 55kA (compared to 43kA) that is manufactured by Travis and has been tested through Powertech Laboratories. The blue 4/0 cable has a higher ampacity rating than any other cable due to 10% more copper and utilizing 99.9% pure copper. By moving to the use of higher rated ground materials, Eversource significantly reduces the need for double or even trip parallel grounds per phase, which improves worker safety and provides an overall human error reduction benefit.

- There are also 6H tools being purchased, which increases the overall ampacity rating of the assembly (cable, ferrules, and clamps) to 55kA, as compared to 43kA and 47kA. When using a full 6H cable assembly, the number of stations that require double parallel grounds reduces by an additional ten (10) stations.

- Based on industry experiences and best practices, the preferred attachment point for ground cables is now to attach to steel/aluminum structures, rather than bringing the ground leads down to earth as Eversource had done before the implementation of the revised TPG procedures. This allows the worker to use the shortest cable possible, which minimizes the exposure voltage at the work site. With this work practice application change, the use of temporary I-Beam clamps, pole band clamps and permanently engineered bolted ball studs are required.

- Also based on industry experiences and best practices, Eversource now requires uninsulated aerial devices to be bonded using a new breakaway bond. This bonding

device shall be used to create an equipotential zone, while creating a safe aerial rescue method and requires a new safety tool meeting the revised work procedure, WMS 89.06-234.

[4] Alternatives Considered

T&D Standards and the Grounding Team Working group evaluated all potential vendors that provide the higher rated 5H and 6H materials. It was identified that Travis was the only vendor that provided the higher rated materials for almost all clamps and materials. There was one (1) other vendor that provided a few options but had not tested the material and full cable assemblies to a full 5H or 6H rating. Therefore, there have not been any other viable alternatives identified at this time that will provide the same work practice improvements and safety impact than the Travis materials and assemblies. T&D Standards has created a sole source justification based on this evaluation.

The other alternative is to continue the existing grounding practices with 4/0, 43kA rated grounding materials. At a minimum, EMA will still require ground cable assemblies and clamps to be purchased, since there were discrepancies identified in the materials available and used (2/0 verse 4/0) as part of the interconnection agreement (IA). All Eversource service areas will also need the new green vehicle grounds per Eversource's new standard, as well as the I-beam clamps, pole band clamps and ball studs. This alternative was not selected as the preferred solution, due to the increased potential for human error over the preferred solution and has not been estimated.

[5] Project Schedule

Milestone	Scheduled Completion Date
IFR Approval	September 2020
SDC Approval (for applicable projects)	N/A
Conversion of Tx development costs, 183 to 107 (applicable to projects that require SSF approval and/or ISO preferred alternative selection)	N/A
EPAC Partial Funding Approval (for applicable projects)	N/A
Preliminary Design Completion (or latest pre-full funding design phase)	N/A
EPAC Full Funding Approval	January 2023
Siting Approval (for applicable projects)	N/A
Start of Construction	N/A
Project In-Service Date (ISD)	Completed - May 2022
Project Need Date (for applicable projects)	N/A
ISO Related Milestones: (for applicable projects)	
• ISO Preferred Alternative Selected	N/A
• PAC Presentation	N/A
• TCA Submittal	N/A

[6] Regulatory Approvals

N/A

[7] Risk and Risk Mitigation Plans

Contingency:
N/A - The project is complete.

Risk Mitigation:

Risk	Mitigation
1. N/A – The project is complete	
2.	
3.	
4.	
5.	

[8] References

References
1. WMS 89.06-234 (W10004 R5) Protective Grounding Inside Substations
2. OSHA 1910.269 - Electric Power Generation, Transmission, and Distribution.
3. ASTM Standard F855: Specifications for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment
4.
5.

[9] Attachments (One-Line Diagrams, Images, etc.)

Attachment	Included in Submittal?
A. Cost Summary	Yes
B. P6 Schedule	N/A
C. Constructability Review	N/A
D. System and Station One-Lines	N/A

Project Checklist - Transmission & Substation Capital Project			
Project Name: CT Dist SS Workman's Grounds	**Project Number: CS00664**		
Facility Type: ☐BPS ☐BES ☐PTF ☐PTF non-regional ☐non-PTF ☐CIP ☐Distribution ☒General Plant			
PLANNING			
Is a NX-9 required?	No		
Is an ISO-NE PAC presentation required?	No		
ISO-NE Presentation Date (if completed):	N/A		
Cost in ISO-NE Presentation ($M) (if completed):	N/A		
Is a PPA required?	No		
ISO-NE Approval Date (if completed):	N/A		
Is a TCA Application Required?	No		
TCA Submittal Date (if submitted):	N/A		
Cost in TCA Submittal ($M) (if submitted):	N/A		
Enter ISO-NE RSP / Asset Condition ID, if assigned:	N/A		
PLANNING/PROTECTION & CONTROLS			
Are RAS/SPS/UVLs affected?	No		
OPERATIONS			
Outage Required?	☐ Primary Equipment (Power Transfer)	☐ Secondary Equipment (P&C only)	☒ Outage Not Required
Do SCLL Conditions Exist?	No		
Has an outage schedule been approved?	NR		
Are Operations & Maintenance procedures/training required?	Yes		
STANDARDS			
Does the project include standard equipment and designs?	Yes		
SUBSTATION ENGINEERING			
Does this impact Revenue Metering	No		
Is preliminary short circuit/ breaker duty analysis required?	No		
Are there any changes to the baseline audible noise?	No		
Is there an impact to the existing ground grid?	No		
Is a Transient Over Voltage (TOV) analysis required?	NR		

Project Checklist - Transmission & Substation Capital Project	
Project Name: CT Dist SS Workman's Grounds	**Project Number: CS00664**
P&C ENGINEERING	
OP-22 - Are PMUs and DDR required?	No
If BPS, is an NPCC Directory #4 presentation required?	No
Are ISO-NE OP-24 Appendix B updates necessary?	No
TRANSMISSION LINE ENGINEERING	
Are there any changes that affect the baseline EMF?	No
Are there any changes that affect the baseline EMI?	No
SITING	
Is a Siting filing required? *(If yes, list in regulatory approvals section)*	No
PERMITTING	
Is there any permitting required? *(If yes, list in regulatory approvals section)*	No
PROJECT SERVICES (OUTREACH) and ROW WORK COORDINATION	
What is the level of outreach expected?	None
Is any part of this project in an Environmental Justice Community?	No
Has ROW Coordination reviewed this project?	No
Is this project coordinating with other existing scheduled work?	No
INITIATOR	
Has a field constructability review been completed?	NR
INVESTMENT RECOVERY	
Does the project require development of an Investment Recovery plan?	No
COST ESTIMATING	
What team/firm prepared the cost estimate?	Other (specify below)
Name of the person who prepared the estimate:	Actuals from PowerPlan - Completed
Was the estimate reviewed by Eversource Estimating?	No

Line item Category	Prior Authorized	Actuals to Date	2023	2024	2025	2026	Total
1. ROW / Easements / Land purchases		$0					$0
2. Environmental Approvals / Permits		$0					$0
3. Outreach		$0					$0
4. Siting Approvals / Permits		$0					$0
5. Engineering / Design		$0					$0
6. Materials (Eversource purchased)		$715					$715
7. Construction (incl matl's by contractors)		$9					$9
8. Testing / Commissioning		$0					$0
9. PMT Project Mgmt Team		$0					$0
10. Removals		$0					$0
11. Other		$0					$0
12. Risks		$0					$0
Project Directs Total w/Risks	**$0**	**$724**					**$724**
13. Indirects/Overhead		$13					$13
14. AFUDC		$0					$0
Project Total - Baseline Budget	**$0**	**$737**					**$737**
15. Contingency		$0					$0
#N/A							
Project Total - Funding Approval Level	**$0**	**$737**					**$737**
16. Reimbursables/Customer Contribution		$0					$0
#N/A							
Project Total (less reimbursables)	**$0**	**$737**					**$737**
Total O&M		**$0**					**$0**
TOTAL REQUEST	**$0**	**$737**					**$737**