



HIGH LEVEL SCOPE OF WORK

DOCUMENT # TROUTDALE, OREGON INTERIOR EXPANSION

VERSION 01 DATE: APRIL 09TH 2014

Site information:

<u>Site Name:</u> Troutdale Headend	<u>Address:</u>	
<u>Division Contact</u> Ian Campbell	<u>Phone number</u> 720-268-8877	<u>SOW Approver:</u> John Lavin
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Color Code:

IAN

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ALPHA

ALL

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Overview:

1. New Electric Service
2. New 400 sq ft +/- Electrical stand alone building
3. New Generators
4. New HVAC
5. Architectural expansion of existing space for new 1200 SQFT technical space.
6. 600 SF storage building (north side)
7. Seismic upgrade existing raised floor at headend.
8. Remodel existing 2700 sf +- headend
9. New fire suppression system at headend, new technical space, and DC battery room.
10. Land use approvals for Conditional Use, Design Review, and Building Permit

Revisions:

Version #2 3/21/14

Generic Steps:

1. Attend Kick-off meeting with Comcast
2. Provide full time in-house project management on-site at all times for critical facilities.
3. Provide full time, qualified, trained, and experienced Lead Installer on-site at ALL times
4. All installation personnel on-site shall be qualified and experienced working in and around high value sensitive equipment, and have full understanding of all items listed below
5. During first day of installation: project management, lead and all installers along with pertinent Comcast personnel shall discuss all rules and regulations required for safe installation not limited to:
 - a. Security of site, parking, gates, and door access
 - b. Identification of all safety hazards
 - c. Delivery requirements
 - d. Working hours
 - e. Protection required for floors
 - f. Protection required for working equipment during delivery
 - g. Protection required for performing SOW around in-service equipment
 - h. Special considerations required for work in DC power room and in-service electrical panels
 - i. Special considerations required for working with and protecting unfused cables
 - j. Special considerations required for working with, protecting, storing and installing batteries.
 - k. Use of electro-shield, Masonite, and flame retardant plywood for protection of exposed -48v busswork, batteries, equipment
 - l. Proper protection procedures for working inside in-service equipment
 - m. Special considerations for protection when working inside in-service BDCBB or DC plant



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- n. Requirements for cable end protection for all cables as they are installed
 - o. Instruction and training for 'booting' of hot conductors
 - p. Fire suppression systems & fire alarm systems are required to be taken off line while any drilling, heat shrinking, brazing, or cutting work is in progress. All alarm systems shall be restored at the end of each working period.
 - q. All contractors must maintain dust free environment during all phases of construction while working in critical facilities. Clean room practices must be adhered to at all times. Install & hang (ASFR) poly sheeting between work area & headend room area. HEPA vacuums or HEPA-vac air filtration system shall be used during all phases of demolition saw cutting, construction, sanding, or painting to maintain dust free environment.
 - r. Safe use of ladders
 - s. Requirements for commercially insulated tools in AC electrical gear and DC power room
 - t. Requirements for properly protected tools for use anywhere in the facility
 - u. Requirements for arc flash suits
 - v. Safe storage of tools, equipment, cable rack, aux bar, etc during the entire duration of the installation
 - w. Proper procedure and identification of area for cutting of steel outside of working equipment areas
 - x. Understanding of lock out-tag out procedures
 - y. Basic understanding of the fire suppression system employed, location of abort stations and instructions for procedures to be followed for any real or false event
 - z. Use of caution tape and cones to warn personnel of specific hazards
 - aa. All installers signing a provided checklist of all items listed above verifying their understanding of all items, and of generally accepted good workmanship and safety practices, OSHA regulations, Lock-out/tag out procedures, etc.
 - bb. Must carry Builder's All-Risk property insurance.
6. Lead installer shall conduct 'safety talks' with all installation personnel on site every day to discuss specific safety hazards and to discuss the plan and procedures to be followed for work steps involved. Weekly, or as needed, review of signed checklist items.

General Scope of work:

1. All pertinent direction provided in the battery manufacturers install manual shall be followed.
2. No-ox and Scotch Brite shall be used for all connections. Use of No-Ox for all connections must be visible during audit inspection
3. Additional generic specification steps may be provided detailing proper workmanship requirements prior to kick-off.
4. Winning Vendor shall provide all necessary MOPS detailing work required
5. Vendor to provide all building or trade permit documentation, as-built drawings, one-line diagrams, & all close-out documentations to be included at completion of all projects.
6. Proper drawing and documentation shall be provided for all work involved, not limited to:
 - a. Test Records for all work completed
 - b. Cable running lists
 - c. Specifications
 - d. Product Information
 - e. Battery test records provide to Comcast and battery manufacturer
 - f. BDFB wiring list if applicable
 - g. AC and DC plant wiring lists
 - h. DC plant controller backup provided via email and copy left on site



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7. Only mfg. certified representatives shall perform the startup and commissioning of all newly installed electrical equipment (UPS, inverter, DC power systems, generators, ATS's, etc.).
 - a. Exception: This requirement is waived if the contractor has received certified training & is authorized by vendor.
8. All work performed shall adhere to all Comcast standards
9. Any deviation in equipment, materials or installation design from the original project scope of work MUST be authorized by the Comcast project manager.

Scope of work specifications

Design & Permitting:

1. Design, engineer, and provide stamped construction documents.
2. Provide all construction permitting
3. Provide all environmental permitting for new generator(s)
4. Attend and present at planning and zoning hearings as required to secure necessary approvals and permits

All Pre-cast building or any type of building installations, building additions & building renovations must adhere to the following permitting and engineering process:

Architect Scope of Services

1. Coordinate with general contractor to establish project budget estimate / verification of programmatic requirements (Comcast) and estimate all project elements
 - a. Drawings: Detailed engineering drawings as needed to provided all items in this Scope of Work. Drawings will be stamped by a professional engineer registered in the state of building placement.
2. Pre-zoning documentation
 - a. Document Existing Conditions
 - b. Field verification of existing building conditions
 - c. Prepare drawings necessary to inform municipal Planning and Zoning Commission and town planner of Site plan modification and building improvements.
3. Code Review _essential (Ip=1.5) building per IBC Chapter 16.
 - a. Review owner supplied building program requirements
 - b. Prepare schematic design- floor plans
 - c. Prepare building code review
 - d. Meet and review with local building inspector and fire Marshall
 - e. Prepare floor plan illustrating all code requirements
4. Preliminary Zoning Review
 - a. Meet with town staff and review preliminary architectural site plan, building plans and proposed elevations.



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- b. Update preliminary design documents to reflect staff review comments.
- c. Meet with civil engineer, and other zoning consultants to review.

5. Architect

- a. Prepare architectural documents for Zoning Commission review

6. Civil Engineer

- a. Prepare demolition plan
- b. Prepare site plan
- c. Prepare grading and drainage plan
- d. Prepare utilities plan
- e. Prepare site lighting plan.

7. Landscape architect

- a. Prepare Site Planting Plan (If required)

8. Zoning Document Filing and review process to approval

- a. Determine and file required documents with Municipality.
- b. Prepare required documents.
- b-c. Track process through jurisdiction.
- e-d. Attend and present at public hearings.

9. Construction Document Services

a. Architect

- 1) Update zoning documents to reflect zoning approval comments
- 2) Prepare construction details for architectural components
- 3) Prepare construction cost estimate for verification of budget
- 4) Procure building permit

b. Landscape architect

- 1) Prepare planting plan as required by site or as to meet Town requirements.

c. Structural Engineer

- 1) Prepare structural review of foundation, framing plans and details of
- 2) Architectural construction documents
- 3) Review specifications for appropriate divisions
- 4) Certify plans as required by building permit review.

d. MEP Engineering services

- 1) Prepare HVAC, electrical plans and details
- 2) Prepare specifications for Divisions 15 & 16
- 3) Certify plans as required by building permit review.

e. Fire Protection – Sprinkler Engineer

- 1) Prepare sprinkler and alarm plans and details
- 2) Prepare specifications for proposed work.

f. Construction Administration



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- 1) On-Site Supervision by general contractor: Manage field activities, coordination of trades and quality assurance.
- 4)2) Architect to provide: shop drawing review; phone clarifications; code required field observations; punch list; attend construction meetings when requested by general contractor for agenda specific items.

Architectural SOW

1. Provide details for new cast-in-place steel reinforced concrete foundation for HVAC and Generators, transformers & utility transformer. Storm drainage with oil-water separator, if required.
2. Provide details for concrete filled steel bollards every 5' around equipment perimeter of generator along parking area.
3. Provide details for concrete transformer vault per utility company requirements.
4. Provide all cutting, patching, trenching, concrete duct banks, backfill, and site restoration to original conditions for primary utility, secondary service, generator and HVAC conduits.
5. Provide stamped architectural drawings
6. Interior architectural improvements, per Comcast Standard (any adjusted for site specific conditions must be approved by Division Power Director) for the following:
 - a. Ground penetrating radar of existing concrete floor with engineering assessment for battery location and Headend area.
 - b. Demolition and disposal of existing interior finishes.
 - c. Interior build out of a new 1200 SQ FT Head End and removal of existing electric room and Network Operations area. Drawings shall reflect future expansion into warehouse area.
 - d. Removal of existing Headend ceiling open to deck. Is there to be a rated drywall assembly installed? Provide all necessary equipment protection during this work.
 - e. Structurally reinforce and certify, where possible, existing Headend raised floor to meet zoning requirements for earthquake based on current code at essential service level
 - f. Vinyl composite flooring with anti-static wax finish for all expansion areas.
 - g. Top off and brace existing drywall partitions to remain and seal new rooms for Clean Agent System.
7. Exterior architectural improvements storage, per Comcast Standard for the following:
 - a. Design and construct a 600 square foot by 12 ft high stick frame storage building on existing poured pad adjacent to building. Must match current exterior design and finish of existing building. Additionally this will require cutting and removing the slab on-grade in order to install new footing and removing and patching non-structural pockets in the concrete (steel column footings temporarily filled with the slab to act as a casting bed for the originally proposed concrete tilt-up panels). Floors, walls and ceilings to be finished.
 - b. Design opening for new 48" wide double door on exterior wall of existing battery room to allow access to new storage building. Sawcut and remove existing concrete wall. Provide and install new 48"x96" hollow metal door and frame with necessary commercial grade door hardware. Seal the opening perimeter and repair finishes as required.
 - c. Design and construct a covered walk way between storage and existing building. 5 feet clear width by 8' clear height.
 - d. Design and construct new concrete 36" walk way to connect existing front side public walk to existing poured pad. This will be for hand truck access to storage from front of building. Repair landscaping and irrigation systems as required.



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8. Exterior architectural improvements new electrical room, per Comcast Standard for the following:
 - a. Design and construct a 400 square foot electrical room to house all new primary electrical service (MTG, GTG) . Must match current exterior and design of existing building.
9. Patching and Painting
10. Design, fabricate and install a new galvanized steel catwalk for access to service doors on both generators. The intent of this landings, stairs, guardrails and handrails at each service door.
11. General Contractor to carry a \$100,000 Allowance for latent conditions, to be used with sole discretion of Comcast.
- ~~11,12.~~ Remove 3 satellite dishes (location to be provided by local team) and foundations and backfill existing holes. This would include SAT coax, AC power, bonding and natural gas piping including rerouting these services to remaining dishes depending upon the ones being removed.
- ~~12-13.~~ Repair of all other site work finishes that will be affected. Sidewalks, asphalt paving, striping, concrete curbs, gravel surfacing, striping, landscaping, irrigation, possibly gate power and controls.
14. The addition will need storm downspouts and underground storm piping.

AC electrical upgrades:

All electrical panels feeding DC power system rectifiers must be sized and calculated using the total FLA (full load amperage) rating of each rectifier being fed from the panel. The following calculation shall be used:

Rectifier FLA (X) Total # of rectifiers (X) 125% (continuous load) = Calculated load

Panel rating (X) 80% = Maximum load to be put on the panel.

Example: Maximum load to be put on a 225 Ampere rated panel.

225 A. X .8 = 180 Amperes is the maximum load to be put on this panel.

SOW

1. Carry a \$55,000 allowance for local utility company charges to provide a new 1600A 277/480V electric service via a new pad mounted transformer located per drawings.
2. Once PO is issued, vendor to supply payment to utility company and coordinate service upgrade
3. Supply and install primary electrical conduits from property line to new transformer location.
4. Provide and install 1200A 277/480V 3PH 4W electrical service to the building.
5. Provide and install step down transformers for convenience power and existing 120/208V Load to remain
6. Provide and install a 150KVA K13 rated transformers for critical 120/208V loads
7. Provide and install a new 1600A UTG and GTG ATS (interior). Switches shall be Isolation Bypass type and rated specifically for the application.
8. Backfeed existing 600A distribution panel 277/480V EP .
9. Provide electrical demolition as required for power, lighting, generator and service equipment.



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10. Provide temporary feeders as necessary to properly sequence work and avoid power interruptions
11. Provide (75) new 277 VAC overhead 2-tube lighting with shatter lamps in the following areas: new power room, new Headend area, any retrofitted area to include existing Headend.
12. Provide 2 qty 20 amp convenience outlets in new storage unit
13. Provide and install 6 new 277 VAC overhead lighting with shatterhshieled lamps in storage unit.
14. Add AC distribution to rectifiers 225 amp 3 phase 480 vac to A2 and B2
15. Surge Protection Devices (SPD) and alarms. Install on all 3 sources

Generator installations:

1. Provide diesel fuel delivery to fill fuel tank to 100% full. Diesel fuel shall be treated with winterized additive.
2. All new generator installations shall meet all the requirements per Article 7.13 / NFPA 110 Standard for Emergency & Standby Power Systems. A complete system Commission and on-site acceptance testing of generator and associated electrical switch gear. Vendor to provide all test reports and documentation

SOW

3. Provide and install (2) new 1000KW 277/480V Caterpillar or Cummins diesel generator
 - a. 1500 Gallon UL142 sub-base fuel tank
 - b. Full tank of diesel fuel. Fill to 90% before and after commissioning. B10 diesel which is the only type of diesel available in Oregon.
 - c. Arcadis permitting per Comcast Corporate requirements.
 - d. Level I sound housing. Check with local AHJ for sound level needed at site.
 - e. Ancillary circuits for block heater, battery charge, start and remote E-stop.
 - f. Each generator provided (2) 1600A circuit breaker (one for load bank).
 - g. Alarms relays for interface with Comcast XOC.
 - h. Electronic fuel gauging, fuel alarms and interstitial leak alarms to XOC.
 - i. Tanks piped together to be able to transfer fuel if one generator is out of service on long commercial power outage with weather restricted access to additional fuel.
 - h-l. Extension of normal main tank vents, emergency main tank vent and emergency interstitial vent to 12 feet above finish grade.
2. Provide and install feeders in conduit to new GTG ATS.
3. Remove, recycle or properly dispose of fuel in existing tank(s)
4. Removal and sell of existing generators.
5. Seismic certification from factory required.



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Exterior/Interior ground upgrades:

All ground wire connections shall be crimped with "H" taps and crimped in a directional ground fault flow manner.

SOW

1. Bond new electrical and HVAC equipment to existing ground ring.
2. Provide a new NEC Code required service ground
3. Provide and new MGB and AGB in new AC power room
4. Provide a new AGB in new Head End
5. Connect existing exterior ground ring to new MGB
6. Connect existing MGB to new MGB and disconnect existing MGB from exterior ground ring.
7. All new Interior DC equipment, cabinets, batteries, etc. to be bonded in accordance with Comcast Standards.
8. Bond MGB to building steel and water pipe with #4/0 green RHH cable.

DC power Upgrade:

All new battery strings must be accompanied with a 10 year full warranty and supporting documentation from the mfg. Only C&D & Deka Unigy (Gulfstream) battery suppliers currently have such agreements in place.

SOW

1. Strap existing DC A and B plant to make a single plant
2. Provide approximately 100LF of GE 10,000A overhead +/- DC Collector bus.
 - a. Provide factory engineered custom bus from power bays
 - b. Provide (12) 1200A battery connection points with shunt monitoring
 - c. Allow for expansion of bus within DC power room for future power bays
 - d. Make provisions for (12) 600A bus fuse positions for future distribution on main floor.
 - e. Make provisions for (8) 600A bus fuse positions in power room for inverter.
 - f. Make provisions for (24) 600A bus fuse positions on main floor for BDCBB distribution.
 - g. Supply and install (2) new 1600A battery strings with disconnects at a two hour rate.
3. Add 3600 supplemental bays at end of rectifier bays.



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4. Add 8000 amp main term bar
5. Shunts at controller to slave master
6. Relocate transformer to allow room for inverter
7. Provide and install (4) Six Panel BDCBB's, each with 6-600 amp loads.
8. Provide and install (20) GMT 100A FAPS.
9. Provide and install (10) KTK 100A FAPS.
10. Provide and install the following diverse DC circuits for direct fed equipment and FAPS:
11. Wiring from FAP to electronics by Comcast.

HVAC Upgrade:

SOW

1. Supply and install (5) exterior Aeon Precision Air Systems 30 ton Glycol split systems. Upflow, ducted overhead supply, iCom or like Controller, w/ humidification and infrared thermal, Front return and access. Intergrated condensate pump and moisture detection. 460v 3 phase.
2. Headend: Supply and install full ducted air distribution supply/return system overhead creating a hot/cold aisle configuration for new Headend area. All supply registers shall have adjustable diffusers.
3. All piping shall be insulated, wrapped in white vinyl interior, fully jacketed aluminum covering with proper straps including bends on exterior, labeled every 10' for flow direction and identification of pipe use.
4. All exterior supports and hardware shall be stainless steel and permanently mounted to walls of slab.
5. Remove all existing water pipes in DC room feeding existing HVAC
6. Rework DC room HVAC ducting to tie into new HVAC units.
7. Rework office HVAC to accommodate comfort cooling.
8. Remove and decommission all existing HVAC feeding Headend
9. Install 2.5 ton HVAC in new exterior warehouse space
10. Remove all perforated floor tiles in existing Headend and replace with solid floor tiles to match manufacture and color.
11. All new units to be factory seismically certified.
12. Provide temporary HVAC as require to maintain existing Head-End cooling as new units are installed and old unit removed in sequence.
- 10-13. Patch and repair all structure and finish surfaces where mechanical equipment and related systems components are added or removed.



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Fire Suppression:

Fire Suppression systems to be designed by a qualified licensed engineer and be designed to meet all requirements of the NFPA 2001 specifications. Commissioning testing must include & pass room integrity "fan" test. Municipal or local fire department to witness test.

SOW

1. Design, supply and install full Clean Agent Fire Suppression (FM-200 or equivalent) for expanded Headend, existing DC Power Room and new AC Power Room.
2. Install a Single Hazard Panel for each room.
3. All alarms should report to the Comcast XOC interface.

Environmental Monitoring:

Vendor shall provide test records that detail all points wired and tested for Proper Operation per Comcast standard for environmental monitoring.

SOW

1. Expand existing monitoring system for all new and existing Comcast required alarm points. Vendor is responsible to install any missing telemetry points within the existing environmental systems as well as add the required new ones.
2. Vendor is responsible for all turn up, control boards, tie into the Spectrum monitoring system and final testing all the way through to the XOC. Onsite Comcast staff will assist with the tie in to the Comcast network to reach the XOC.

Security/Fire Alarms:

All security installations must adhere to Comcast Corp. Security Installation Standards.

SOW

1. Provide badge access for all new doors. Wire to existing badge access system.
2. Provide all necessary exit signs, horn/light strobes, pull stations (see Fire Suppression), fire extinguishers and clean agent in equipment areas. Emergency lighting and smoke detectors for new and existing areas that are required by NFPA, local municipality and Comcast standards

Infrastructure:

SOW

1. Supply and install 500 lf (1500 ft total) of gold chromate ladder 3 tier in new Headend and battery room. Provide gold chromate stanchions where required.
2. Supply and install 250 lf of fiber management, manufacturer per Comcast Regional Mangement.
3. Supply and install 30 express exits for fiber management



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4. Provide and install (40) (36" deep / New Comcast equipment rack w/ cable management package spec., 22 5/8"W x 48RU x 36."D, Black) equipment cabinets in headend room bolted to the floor.
5. Provide and install (10) (48" deep / New Comcast equipment rack w/ cable management package spec., 22 5/8"W x 48RU x 48D, Black) equipment cabinets in headend room bolted to the floor.
6. Provide and install (10) open-frame realy racks
7. All new cabinets to be oriented in a hot/ cold isle manner.

UPS:

SOW

1. Not in Contract.

Telecommunications & RF Cabling:

2. Not in contract, Comcast to perform with own forces.

Timeline for Implementation:

Need quotes by 4/28/14

General Product Information:

1. Caterpillar/Cummins Generator
2. Interior Mounted Bypass Isolation ATS
3. GE/Lineage/ Alpha DC plants and Bus
4. East Penn or C&D batteries
5. Emcor Equipment Racks
6. Quest or RLE Controls Monitoring system with Demarc alarm box