

# Water/Sewer/Drainage Electrical Specifications



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## ELECTRICAL SPECIFICATIONS

# Kiosks

### Utility Kiosks

1. Kiosk are to be designed to contain all control and telemetry equipment on the front panel and all power equipment on the rear panel.
2. Kiosk shall be powder coated to the City of Kamloops' color specification available from the Utilities Pumping Facilities Supervisor.
3. The kiosk shall have a thermostat controlled ventilation fan to ensure the inside temperature does not exceed the outside air temperature.
4. One end of the kiosk will be used to accommodate motor and control connections. Access to this area will be a lockable hinged door. The explosion proof isolation will occur at this point between this area and the remainder of the kiosk area.
5. The kiosk will be positioned so that the motor and control connection end of the kiosk will be as close as possible to the station. Conduits will exit the kiosk towards the station or valve chamber in a straight line wherever possible.
6. Each motor or power circuit shall have its own conduit. Control cables for level control and flygt bulbs may share the same conduit.
7. Conduits leaving kiosk shall be rigid PVC (minimum size 2" or 50 mm) otherwise sized to accommodate easy installation of motor feeders.
8. This section will apply to kiosks for sewer lift stations which do not have permanent generators on site. These kiosks shall be equipped with the following:
  - a) Square D transfer switch cat #C82343.
  - b) Crouse Hinds receptacle AR1042S22 c/w AJ47.
  - c) The 60 amp receptacle will accommodate the 208 volt, three phase systems.
  - d) The 100 amp receptacle will accommodate the 600 volt, three phase systems.
  - e) On a single phase service pin 2 will be used for the neutral connection.
9. The kiosk will have an incandescent type light inside as well as a 120-volt, 20-amp "T" slot receptacle with the wiring being #12 AWG stranded.
10. Control voltage along with lighting loads will be supplied with a minimum 7 KVA transformer.
11. Kiosk shall be sized to easily accommodate all the electrical equipment which it houses and be approved by the City of Kamloops.
12. Kiosk walls shall be insulated using 1" foil insulation and appropriate fasteners.

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13. Kiosk used for PRV or Reservoirs will have the following dimension: 1,220 mm (4 feet) wide, 1,220 mm (4 feet) high, and 915 mm (3 feet) deep. The doors will be installed on the 1,220 mm side. One side will contain the control cabinet and the other side house the hydro service.
14. Kiosk Hardware specifications:
  - a) Hinges (steel weld-on c/w grease fittings) length 100 mm, diameter 20 mm, pin diameter 9 mm, bearing capacity approximately. 440 lb. Faucher-Part #752-0672.
  - b) Padlockable Handle 0.94 lb. 6" zinc plated c/w 5/16" shank Faucher-Part #671-1000.
  - c) Handle mounting screws 10/24 x 5/8" stainless steel machine screws with 10/24 nylon locking nuts. Note when mounting (clear silicone caulking is used between surfaces of handle and cabinet for better weatherproofing.  
  
3-point lock (center case) zinc plated (3.75 lb.) 6 5/6" x 2 1/2" base Faucher-Part #700-1966
  - d) 3/8" diameter zinc plated locking rods Faucher-Part #700-2060.
  - e) Rod guides 3/16" thick x 1" wide x 3 1/2" long zinc plated c/w spring tensioner:
    - Faucher-Part #700-1719
    - Striker plate 3/16" thick x 1 3/4" wide x 2 1/4" long zinc plated Faucher-Part #700-5449 plug welded in place. Note this is a rod guide but is also designed for use as a striker plate as seen on the kiosk.
  - f) Kiosk shall be constructed of #10 gauge steel.

## PRV Valve Chambers and Kiosks

### Valve Chamber

- Valve chambers will have power and controls or monitoring devices supplied from an approved City of Kamloops Kiosk.
- Data transfer to a SCADA system will be a dedicated lease line or wireless. The City of Kamloops will decide on the preferred method of communication for each PRV station.
- A 20-amp 120 "T" slot receptacle will be installed dedicated for a portable heater.
- The heater will have a shelf fastened to the wall so the heater does not sit on the floor.
- The chamber will also have an incandescent light housed inside a weatherproof rab style fixture along with a 20-amp "T" slot receptacle.
- Switches and receptacles shall spec grade.
- Weatherproof cover plates will be provided for all switches and receptacles.

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- The chamber will be monitored for low temperature alarms.
- The chamber will be equipped with a flood flygt bulb.
- Discharge and suction pressure transmitters shall be installed to the City of Kamloops specifications.
- Transmitters to be mounted directly to water line and not remotely mounted on chamber wall.
- Junction boxes inside the chamber will have hinged covers and be made of aluminum, PVC, or Fibreglass material.
- No plastic wall anchors will be allowed in concrete. Anchoring to concrete shall be by the use of lead only.
- Lighting and receptacles will be wired with #12 AWG copper with no #14 AWG permitted.
- Control wiring in either in Teck or conduit will be #16 AWG.
- There shall be no junction or pull boxes permitted between kiosk and chamber.

### PRV Kiosks

- Kiosk will meet City of Kamloops specifications.
- Kiosk to be designed to contain all control and telemetry equipment on the front panel and all power equipment on the rear panel.
- The kiosk shall be positioned as close as possible to the valve chamber and conduits leaving the kiosk must leave the kiosk and enter the valve chamber in a straight line.
- A minimum of two conduits will be used between Kiosk and valve chamber not smaller than two inches or 50 mm ridged PVC.
- The kiosk shall be serviced with a minimum Hydro service of 60 amps 120/240 volt.
- The kiosk will have an incandescent type light inside along with a 120-volt, 20-amp "T" receptacle.
- Kiosks will have the following dimension: 1,220 mm (4 feet) wide, 1,220 mm (4 feet) high, and 915 mm (3 feet) deep. The doors will be installed on the 1,220 mm side. One side will contain the control cabinet and the other side house the hydro service.
- Control components will meet City of Kamloops specifications.
- All wiring to doors to be bundled with sufficient slack to allow doors to open fully, bundle to twist at door and not bend.
- Completed panel to be fully tested on site. Testing is to be scheduled in advance of start up in order to enable a City of Kamloops representative to witness and at the same time to fully commission the station to the City's satisfaction.

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- Control cabinet door shall not have any pilot lights. The HMI will display the following information:
  - Flow in litres per second.
  - Discharge and Suction Pressure in Kilopascals.
  - Station alarms such as high and low pressure, low temp, chamber flood etc.

## Utilities Buildings

- Whenever Teck cable is installed then the appropriate weatherproof aluminum connectors shall be used. The use of dry type connectors with Teck cable is prohibited.
- Teck cable shall be clearly and permanently identified at each end of the cable in accordance with the cable schedule.
- When Teck cable or conduit is run on the surface, it shall be supported by the use of one hole rigid straps.
- No plastic wall anchors shall be used on concrete or block construction. Only lead anchors are permitted.
- Where conduit is used, it shall contain stranded wire only. The use of solid wire is prohibited.
- The use of BX cable is not permitted.
- All wiring on the inside of the building shall be wired as if it was exposed to the elements.
- Where applicable electric heaters shall have fans integral to the heater. The heaters shall contain a built-in thermostat as well as the necessary contactors. The voltage will match the station voltage and not be fed from the lighting panel.
- Electric Heaters that are mounted with a swivel bracket will be fed with either teck cable or liquid tight from the local lockable disconnect (Hubbel HBL13R89D or equivalent). This will allow the heater to swivel for servicing. In addition, each heater will have its own breaker (no doubling up of multiple heater circuits under one breaker).
- Indoor lighting will be fluorescent T8 lamp rated ballasts at 120 volts. The fixture shall be vapour proof style. Fluorescent lighting shall be used where the ceiling does not exceed 4 metres. (LED, Inductive or T5 HO 54 watt will be considered at the discretion of the Electrical Department)
- Ceilings exceeding 4 meters will have either mid or high bay lighting approved by the City of Kamloops electrical department. These fixtures shall be vapour proof. (LED, Inductive or T5 HO 54 watt will be considered at the discretion of the Electrical Department)
- At the discretion of the electrical department, where access to mid or high bay lighting could be an issue, remote ballast that is accessible shall be used with the fixture.

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- All lighting and receptacles will be wired with a minimum #12 AWG wire.
- #14 AWG will not be permitted.
- Control wiring in either Teck or conduit will be #16 AWG max.
- Exterior lighting must be approved by the City of Kamloops.
- No aluminum wire will be used for services or associated feeders.
- Switches and receptacles will be spec grade. Receptacles will be 20-amp "T" slot, wired with #12 AWG stranded and supplied by a 20 amp single pole breaker.
- Weatherproof cover plates will be provided for all switches and receptacles.
- Panel boards will be mounted on white painted plywood good one side backboard.
- All circuits shall be identified.
- Motor Control Centers will be mounted on top of min. 10 cm housekeeping pad.
- The BC Electrical Code (CEC), Part 1, 2009 Edition, now contains a requirement for arc flash labelling and will reference **NFPA 70E** and IEEE 1584, CSA Z462.
- Where the characteristics of the electrical distribution meet the requirements of an arc flash assessment, adequate labelling shall be installed so as to meet the requirements of the BC Electrical Code and CSA Z462.
- This required labelling addresses the concern of protecting qualified persons who work on energized electrical systems by ensuring that they are notified of the arc flash hazards to assist in the selection of proper PPE.

### Logical STEPS:

#### **STEP 1 - DATA COLLECTION**

Transformer, Conductor, Utility Company, Motor, Over-current Device and Generator Data.

#### **STEP 2 - DEVELOP THE SINGLE LINE DRAWING**

#### **STEP 3 - SYSTEM MODELING FOR ARC FLASH STUDY**

High vs. Low Fault Current, System Configuration, 125 kVA Transformer Limit.

#### **STEP 4 - IEEE Std. 1584™ - ARCING CURRENT CALCULATIONS**

Arcing Current Calculations, Defining the Arc Gap Based on Equipment Type, K1 for Arc in Box vs. Air.

#### **STEP 5 - TIME CURRENT CURVES**

Determining the arcing current clearing time, 85% vs. 100%, 2 second cut off Interpretation.

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### STEP 6 - IEEE Std. 1584™ - INCIDENT ENERGY CALCULATIONS

Incident Energy Calculations, K2 and Effect of Grounding, Impact of Device Settings.

### STEP 7 - IEEE Std. 1584™ - FLASH PROTECTION BOUNDARY CALCULATIONS

Flash Protection Boundary Calculations Based on Incident Energy, Calculation Factor CF, Distance Factor X, 4 ft. rule vs. Detailed IEEE Calculations, Unusually Large Boundaries.

### STEP 8 - DETERMINING PPE REQUIREMENTS

Using calculated incident energy to determine PPE. Comparing this method to NFPA 70E Tables.

### STEP 9 - ARC FLASH WARNING LABELS TO BE INSTALLED:

Labelling Requirements, Approach Boundaries, Class of PPE, Standardizing Labels.

### STEP 10 - REPORT AND RECOMMENDATIONS

Reducing Incident Energy, Arc Resistant Switchgear, Design and Operating Changes, Current Limiting Devices, and "Holes" in Present Standards.

- In station upgrades the removed equipment shall be returned to the City of Kamloops Electrical Department.

## Utility Electrical Component

### Components

**All equipment to be purchased on behalf of the of City Kamloops (Registered Owners for warranty on equipment) The City of Kamloops needs to be the owner of all equipment in order to deal with warranty or future recall concerns.**

1. Only aluminum weatherproof Teck connectors will be used with Teck cable.
2. **Soft starts - Benshaw MX3 series of starters.**
3. **Variable Frequency Drives - Cutler-Hammer, Schneider Altivar 61 and 71 Drives**
4. The preference for driving motors will be a Soft Start or VFD. Where combination starters are used, these stations will come equipped with a phase monitor. An input will be provided to the PLC for power quality status.
5. **Acceptable Motor Control Centers - Square D, or Cutler-Hammer/Eaton**  
Motor Control Centers communication (Ethernet or Devicenet). Method of communication to be approved by the City of Kamloops Electrical Department. MCC Centers will have surge protection.
6. Combination starters for use in Kiosks or buildings - **Square D or Cutler-Hammer/Eaton**  
The combination starters will have a fusible disconnect and contactor with electronic overloads. NEMA or IEC starters will depend on the application, and be approved the City of Kamloops Electrical Department.

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7. Motors to be 600-volt three-phase or as approved by the City of Kamloops electrical department.
8. Motor junction boxes from the manufacture must be approved by the electrical department. If the box is deemed to be small, a new aluminum junction box shall be fabricated to the following specifications.
  - a) Constructed of 3/16 inch aluminum
  - b) Hinged on the left vertical side
  - c) Lockable Hasp installed on the right vertical side
  - d) Size to be determined by the Electrical Department

Medium voltage motors with a cast iron cover such as the covers on US Electric motors shall have the cover discarded. A new aluminum cover matching the original cast iron covers dimension shall be fabricated and installed in its place.
9. Power factor correction shall be calculated and correction of PF shall occur to ensure that no surcharge penalty will be accessed by BC Hydro.
10. In locations where the only voltage that is available from BC Hydro is single phase power then Variable Frequency Drives will be installed to generate a third phase.
11. No single phase motors shall be used, unless prior approval is obtained from the City of Kamloops electrical department.
12. Five spare fuses shall be provided for all fuse holders or per three phase fuse block.
13. Kiosks or buildings that do not have standby generators will have the following in place to allow a portable generator to be connected:
  - a) Square D transfer switch cat #C82343.
  - b) Crouse Hinds receptacle AR1042S22 c/w AJ47.
  - c) The 60 amp receptacle will accommodate the 208-volt three-phase systems.
  - d) The 100 amp receptacle will accommodate the 600-volt three-phase systems.
  - e) On single phase service pin 2 will be used for the neutral connection.
14. Solid wire shall not be used, all wiring shall be stranded.
15. Electric heaters will be Caloritech which will have thermostats and built in contactors rated for station voltage.
16. Cable tray shall be aluminum only.
17. **Panel boards and Motor Control Centers shall be either Square D or Cutler-Hammer-Eaton.**
18. All transformers will have copper windings only (no aluminum).

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# Control Components

The components listed are presently approved by the City of Kamloops Electrical Department

1. 24-volt D.C. power supplies Idec series PS5R-D24 and sized for the appropriate control cabinet.
2. Terminal
  - a) Entrelec series 011511811 or 011511607 with accessories.
  - b) Wieland Terminal Block
    - 6 mm (57.504.0055.0) with accessories
    - 8 mm (57.506.0055.0) with accessories
3. **Human Machine Interface's shall be EATON OR SCHNEIDER SERIES.**
  - a) Simple duplex pump stations where the control panel is located inside of a **building** will require the use of the Eaton HMI Cat#HMIO6CE
  - b) **Larger Stations**
    - i) E-Pro series 7685T-8C.
    - ii) Schneider 10" TS 65536 Colours (TFT) XGA Cat # (XBTGT5340)
  - c) **Major Stations**
    - i) E-Pro series 7685T-15C
    - ii) Schneider 15" TS 65536 Colours (TFT) XGA Cat # (XBTGT7340)
4. Cutler-hammer Power Filter AGSHWCH120N10XS (AEGIS 120 volt 10 amp).
5. Weidmuller Breakers series 91010000.
6. **Programmable Logic Controllers.**

(PRV stations will either have a SCADA pack 100 wireless or a Modicon PLC as listed below. The electrical department will approve the appropriate PLC.) All other utilities stations will use the following PLCs. (MODICON SERIES FROM SCHNEIDER).

- a) Modicon M340 or Quantum series of CPUs  
PRV's or Reservoirs ScadaPack PLC's will be permitted.
- b) M340 modules used or approved by the electrical department.
  - BMX DRA 1605 Output module
  - BMX AMI 0410 Analog input module
  - BMX DAI 1604 Input module
  - BMX AMO 0210 Analog output module
  - BMX XBP 0600 6 slot back panel

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- **M340 modules will use the following cord sets wired to appropriate terminal strip.**

Analog modules will use	BMX FTW 301S
Discrete modules will use	BMX FTW 301

**c) Quantum Modules presently used or approved by the electrical department.**

- 140ACI-030-00 Analog input module
- 140ACO-020-00 Analog output module
- 140DAI-553-00 Input module
- 140DAO-840-00 Output module

7. Wire labels will be printed with a Brady TLS2200 with PSPT-187-1W labels.
8. Off delay timers for back-up sewer control GT3F-2AF20 120 volt IDEC.
9. Intrinsic Safety Repeater (PEPPERL+FUCHS PN#103370 KFA5 SR2 EX2.W)
10. Relay bases IDEC SR3P-06, SR2P-06, or SY4S-05.
11. Selector switches, and push buttons will be Allen Bradley series 800T J2B or approved by the electrical department.
12. Narrow slot T&B wire way only to be used sized for wire fill.
13. Modems will be U.S. ROBOTICS 56K V EVERYTHING PN#USR3453B
14. Modbus Plus Devices
  - a) 990NAD-230-20 Modbus Plus Super Tap, Din rail mount
  - b) 990NAD-230-22 Super Tap Terminating resistor
  - c) 990NAD-211-10 Modbus drop cable
15. Ethernet to Modbus Bridge
  - a) TSXETG100 Ethernet - Modbus Bridge
16. Ethernet to Modbus Plus Bridge for the M340 PLCs
  - a) TCSEGDB23F24FA
17. Unlicensed Radios (900mhz **Freewave** Radios typically used with the ScadaPack 100 PLC).

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# Control Wiring and Methods

### Cabinet Control

1. The cabinets will be constructed of aluminum or powder coated steel (weatherproof construction), hinged on one side and provided with a lockable hasp. The cabinet will come with a back pan to allowing mounting of electrical components.
2. The front door will contain an HMI with reset button and a hand off auto for each pump. Sewer control panels will also have emergency backup selector switch. To select the emergency pump - the hand off auto selector switch will be wired that the hand position will be on the left, off will be in the center, and auto position will be on the right.
3. Conductors entering a control cabinet shall enter a T&B wire way sized to sufficiently hold the control conductors, before terminating on a terminal strip.
4. Grounds entering the cabinet such as from Teck cable shall be bonded to the cabinet at the closest point and in no way be brought inside the plastic wire way.
5. The terminal strip shall be located where the majority of outside control cables enter the cabinet.
6. Cabinets will be completely finished including being vacuumed before commissioning.
7. The entire cabinet components will be protected by the surge suppressor.
8. Wire size within the cabinet to be #18 AWG TWU stranded, and leaving the cabinet will be a max size of 16 AWG stranded.
9. Wire colours inside the cabinet or inside the conduit leaving the cabinet as follows.
  - AC LINE RED
  - AC NEUTRAL WHITE
  - 24 VOLT D.C. POSSITIVE BLUE
  - 24 VOLT D.C. NEGATIVE YELLOW
10. Input and Output (I/O) addresses will be assigned to the individual control wires and remain the same throughout its run as well these numbers will be shown on schematic drawings.
11. Each cabinet will have a heater and a ventilation fan (of sufficient CFM) and appropriate thermostat to control inside cabinet air temperature.
12. Stations with stand-by generators will have the control cabinet isolated through an Uninterrupted Power Supply (UPS)
13. Labels on front door and inside components to be labelled with Brother Labeller or lamicoid and be a minimum of 18 mm in width. Labels shall be affixed to the panel and not wire way.
  - a) UPSs are not be located inside **wall mounted control panels nor inside control panels installed within Kiosks**. These control panels will be fitted with the following adapters to accommodate a receptacle for a UPS:

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- i) Flanged Nylon Receptacle Hubbel Cat# HBL5279C
  - ii) Flanged Nylon Inlet Hubbel Cat# HBL5278C
14. Front doors will be free from scratches and dents.
15. Cabinets shall be large enough that overcrowding of the components and wiring does not occur.
16. All wiring within the cabinet shall be labelled with a Brady TLS2200.
17. Where DIN RAIL is installed such as to support a PLC it will span the entire width of the back pan. All components shall be arranged to leave maximum possible space for future use, and be DIN RAIL mountable.
18. Enough space will be left on PLC DIN RAIL to allow a second PLC rack to be installed.
19. Storm and sewer will have a backup control to operate pumps in an event of PLC failure using an off delay timer and high level flygt bulb.
20. Modicon Controllers will be programmed with the latest version of "Unity" or other approved software by City of Kamloops Facilities and Trades Section.
21. Unity programming will have sections dedicated to specific functions such as the following:

Scaling of analog signals, motor set points, starts, stops, and station alarms, etc.
22. Unity programming language used will be acceptable to the City of Kamloops Facilities and Trades Section; IEC function block is preferred.
23. All wiring to doors to be bundled with sufficient slack to allow doors to open fully, bundle to twist at door and not bend by running vertically on the hinge side.
24. Completed panel to be fully tested on site. Test date to be scheduled well in advance to allow city representative to witness station commissioning.
25. Control cabinet door shall not have any pilot lights. The door will have an HMI, a hand off auto for each pump, and in the case of duplex sewer pump system a selector switch designating the emergency pump.
26. The HMI will display the following information:
  - Pump run hours.
  - Start and stop levels as well as high and low level alarms.
  - Pump status such as on, off, and failure.
  - Pump status with color HMIs on-green, off-red, and fail-yellow.
  - Also other station alarms such as power quality, temp, or communication alarms.
27. All Input and output PLC points will be wired to a terminal strip.

## **Generator Specifications for Sanitary Sewer (2 pump Operations)**

1. Where standby generators are used a transfer switch shall be located inside the hydro side of the kiosk.
2. Transfer Switch Manufacturer: Cummins Onan, Model OTEC Range 40-1,000 amps.
3. The Generators will be Cummins specification or equivalent with output voltage to match hydro supply to the station.
4. Transformers will not be used to step up or down voltage from a generator to match hydro supply.
5. In these stations hydro distribution will be 600-volt, three-phase.
6. If hydro is not able to supply 600-volt, three-phase then 208 volt, three phase will be considered.
7. The generator will provide inputs to the PLC such as: generator run, fail, low coolant temperature, low fuel, and low oil pressure.
8. The generator engine shall contain plug in block heaters so as to allow easy change out of units.