Guide Form Specification for Medium Voltage Switched Shunt Reactor Bank

- Liquid Filled/Insulated & Dry-Type Iron Core Shunt Reactor Design –

1 General

1.1 This specification is for a medium voltage switched shunt reactor bank. The reactor bank shall have a total 3-phase reactive power rating of _____ kvar at _____kV and shall be switched in _____ steps of _____ kvar. The shunt reactor bank shall be equipped with all switching, protection, and control and shall be shipped completely assembled, tested, and ready for operation.

1.2 The rating of the shunt reactor bank and associated switchgear, and switching devices shall have ratings designed for application on the following system:

Nominal System Voltage, (Kv)…… _____
Maximum System Voltage, (Kv)…….…. _____
System BIL, (Kv)……..…… _____
Three Phase Short Circuit Rating at Reactor
Bank (RMS Symmetrical Amps)……_____
Line-Ground Short Circuit Rating at Reactor
Bank (RMS Symmetrical Amps)……_____

1.3 Ambient Air Temperature for design shall be as follows:

Average annual temperature…..……..…….Min_____/Max_____ (degrees C)
Average Daily variation …… _____ (degrees C)
Design temperature ……..…Min. _____/Max_____ (degrees C)

1.4 Relative Humidity for design shall be as follows:

Monthly Average Relative Humidity ……..…….Min._____/Max_____ (%)
DesignRelative Humidy ……..……Min. _____/Max_____ (%)

1.5 Solar radiation for design purposes shall be as follows:

Average annual solar radiation ……..…….…. _____ (kW/m^2)

1.6 Precipitation for design shall be as follows:

Average annual precipitation ….……_____ (mm)

1.7 Snow Load for design shall be as follows:

Maximum design snow load ….……..……_____ (kG/m^2)

1.8 Wind for design shall be as follows:

Basic wind speed (V) ……_____ (km/h)
……corresponding to a 3 second gust speed
…….…….. Standard height of 10m above ground

Prevailing winds …… _____ (N, S, E, W, etc)

1.9 Seismology for design shall be as follows:

All building, structures, and components shall be designed for earthquake forces according to the _____. Note the following data as it pertains to this location:

2 Compliance with Standard & Codes

The metal enclosed shunt reactor bank shall conform to or exceed the applicable requirements of the following standards and codes:

- ANSI C57.12.21 Standard Requirements for Shunt Reactors over 500 KVA.
- UL-347, High Voltage Industrial Control Equipment
- UL-508, Industrial Control Panels, Issue Number: 2, October 1993
- UL-50, Standard for enclosures for Electrical Equipment
- ANSI Z535.4 Product Safety Label Standard July 1, 2002.
- Article 470 of the National Electrical Code
- ANSI C37.20.2 – Guide for Enclosure Categories and Related Requirements

3 Product Listing

3.1 The shunt reactor bank control system shall be UL508A Certified for both Canadian and US products.

3.2 The shunt reactor bank shall be “listed” per OSHA (in the USA) and the Standards Council of Canada (in Canada) to the following standards.

- For products shipping to the United States, IEEE C37.20.3-2001
- For products shipping to Canada, C22.2 No. 190-M1985+GI1 + GI2 (R2004)

A copy of the NRTL Certificate showing compliance with the above shall be included with the bid.

4 Enclosure Construction

4.1 The manufacturer of the enclosure shall also be the assembler of the shunt reactor bank. This is to ensure the highest degree of control with respect to critical enclosure manufacturing processes such as cleaning and surface preparation, welding, priming, and painting.

4.2 The shunt reactor bank shall consist of a single (1) flush door enclosure with NEMA 3R construction that will house all components, including controls, fuses, reactors, switches, and RC Snubbers for limiting transient recovery voltage. All components shall be accessible and removable from the front or side of the enclosure. Bolted panel construction, transclosure style, and switchgear cubicle style enclosures will be rejected.

4.3 The enclosure shall be fabricated from 11-gauge cold rolled A60 galvaneal steel. The roof shall be cross-kinked, half gabled, or full-gabled to allow for watershed.

4.4 The enclosure shall be prepared and painted with a high-solid epoxy coating as specified below. The inside shall be white while the outside shall be (ANSI gray 61 – Munsell No. 8.3G 6.10/0.54, ANSI Gray 70 – Munsell No. 5BG 7.0/0.4 or Green - Munsell No. 7Gy 3.29/1.5).

Surface Preparation:
All steel surfaces shall be prepared per SSPC-SP2, 3, 6, 7, 10, 11 or the paint manufacturer's recommendations. Exceptions to the manufacturer's requirements shall be approved by the paint manufacturer and provided with the submittal documents.

Inaccessible Surfaces:
Prepare and coat steel surfaces inaccessible to preparation and coating after fabrication with all coats before fabrication. Inaccessible surfaces shall be considered Zone 2A per SSPC specifications.

Paint Specifiction:
All surfaces, inside and out, shall be top coated with a High-Solid Epoxy paint with a dry film thickness of 2 to 3 mils. This will provide a total dry film thickness of 3.5 to 8 mils.

The paint utilized shall have the following properties:

- Salt Spray (ASTM B117) 5500 Hours with no face blistering
- Humidity (ASTM D2247) 5500 Hours with no face corrosion or blistering
- Gloss retention (ASTM G53) QUV-B bulb: Greater than 50% gloss retention at 26 weeks.
- Elongation (ASTM D5222) 14%
- Abrasion resistance (ASTM D4060) 1kg load/1000 cycles, CS-17 wheel: 53 mg weight loss.
- Impact resistance (ASTM D2794): Direct 24 in.lb and Reverse 6 in.lb.
- Adhesion, elcometer (ASTM D4541): 2700 PSI
- NFPA Class A Qualification

Paint shall also provide excellent chemical resistance to splash, spillage, fumes and weather for acidic, alkaline, salt solutions (acidic, neutral, and alkaline salt solutions), fresh water, solvents and petroleum product environments.

Upon request, the manufacturer shall provide supporting documents (surface preparation procedures as well as paint manufacturer's paint specifications) showing the above requirements are met. Failure to comply with this request will be cause for cancellation of order.

4.5 The enclosure shall have a continuous 1/4" x 2" Tin-Plated Ground Bus that spans the full width of the enclosure.

4.6 The doors shall be of a flush design (no over hanging door sills) equipped with heavy-duty stainless steel hinges and 3-point latching handles. The handles shall be pad lockable. The Doors shall be removable in the open position.

4.7 All doors providing access to high voltage compartments shall be equipped with door stays to hold doors in the open position. All doors shall be equipped with a drip shield.

4.8 In addition to the enclosure door, the compartment containing the load-interrupter switch shall be equipped with an internal hinged protective barrier that guards against inadvertent entry to the terminals of the load-interrupter switch. Access to any portion of the load-interrupter switch shall be blocked by the barrier while allowing access to the main fuses (if supplied).

4.9 The base of the enclosure shall be equipped with C4x5.4 structural steel channel. Removable steel lifting plates consisting of 1/2" steel shall be located at each corner. Formed channel bases will not be accepted.

4.10 All ventilation louvers shall be located on the front, (you may also specify back or sides) of the enclosure and shall be equipped with 2" (5.08 cm) 20x20x2 MERV 5 Fiberglass filters. Filters shall be removable while the bank is energized. Live parts shall not be accessible while filters are removed. All fasteners and associated hardware, inside and out, shall be stainless steel. Externally accessible hardware shall not be used for support of high-voltage components or switch-operating mechanisms within the reactor bank.

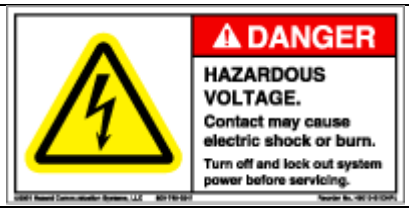
4.11 Thermostatically controlled fan(s) shall be provided to cool the shunt reactor (when necessary).

4.12 Thermostatically Controlled Strip Heaters shall be supplied in all non-ventilated compartments. When determined by the manufacturer, a thermostatically controlled fan or ventilator shall be supplied. Heat/Temperature rise calculations shall be supplied upon request, and provided in the submittal package.

4.13 The shunt reactor bank shall be name plated with a riveted anodized steel nameplate containing the following information:

- Nominal System Voltage
- Maximum System Voltage
- Number of Steps, Stages, and Switching Sequence
- kvar per step and kvar of each stage
- BIL
- Accuracy

4.14 Each door of the enclosure shall be equipped with self-adhesive vinyl warning signs that comply with ANSI Z535.4 Product Safety lable Standard dated July 1, 2002.

Warning Label Requirements per above section	
	
Electric arc flash hazard. Will cause severe injury or death. Wear proper protective equipment before opening or performing diagnostic measurements while energized. (See NFPA 70E)	*HAZARDOUS VOLTAGE. Contact may cause electric shock or burn. Turn off and lock out system power before servicing.*

The following optional requirement can be specified as required:

4.15 Doors providing access to interrupter switches shall be provided with a wide-view window constructed of an impact-UV-resistant material, to facilitate checking of switch position without opening the door.

4.16 The main incoming fuse compartment shall be equipped with a wide-view window constructed of an impact-UV-resistant material, to facilitate checking of the main fuses without opening the door or de-energizing the bank.

4.17 The reactor compartment shall be equipped with a wide-view gasketed window constructed of an impact-UV-resistant material, to facilitate checking of internal components without having to open the door or de-energizing the bank.

5 Dry-Type Shunt Reactors

(For shunt reactor banks rated 15kV (less than 110kV BIL), the shunt reactors may be specified dry-type with ratings to 1000 kvar 3-phase)

5.1 The shunt reactor shall be equipped with single-phase iron-core dry-type reactors. They shall have Copper windings and a 220°C insulation system with a 80°C temperature rise over a 60°C ambient.

5.2 The reactors shall be Vacuum Pressure Impregnated (VPI). The iron laminations shall be a hi-grade magnetic steel. To reduce gap magnetic losses and extraneous magnetic fields, a distributed gap design shall be utilized.

5.3 All gaps shall be cemented to reduce noise levels. The reactor design must be designed for 10% over-voltage.

6 Liquid Filled/Insulated Shunt Reactor(s)

(For shunt reactor banks rated to 38kV (200kV BIL and lower), the shunt reactors may be specified as oil insulated)

6.1 The reactor(s) shall be mineral oil filled and shall be in accordance with the latest edition of the NEC. High fire point fluids (i.e. RTemp, FR3, etc.) may be quoted as an option, and shall be Factory Mutual and UL listed.

6.2 The reactor(s) shall be supplied with high voltage bushings. A neutral bushing shall be supplied and shall be fully rated to allow for grounded or ungrounded operation of the shunt reactor.

6.3 The shunt reactor(s) shall carry its continuous base rating with an average winding temperature rise (by resistance test) that does not 65° C, based on an average ambient of 35°C rise over an ambient of 30°C over 24 hours with a maximum of 40°C.

6.4 The shunt reactor(s) shall be designed to meet the sound level standards for liquid filled reactors as defined in ANSI C.57.12.21.

6.5 High-voltage windings shall be copper, no exceptions. Insulation between layers of the windings shall be by high quality paper or equal.

6.6 The shunt reactor tank(s) and attached components shall be designed to withstand pressures 25% greater than the required operating design value without permanent deformation. Construction shall consist of carbon steel plate reinforced with external sidewall braces. All seams and joints shall be continuously welded.

6.7 Each radiator assembly (if required) shall be individually welded and receive a quality control pressurized check for leaks. The entire tank assembly shall receive a similar leak test before core and coil are tanked. A final six-hour leak test shall be performed after the shunt reactor is tanked, welded and completed to ensure that there are no leaks before shipment.

6.8 The shunt reactor tank(s) shall be have a drain and filter valve, a sampling device, and a 10 PSI pressure relief valve that reseals on operation. The cover shall be fully welded with a minimum of 3/8" thick steel. The tank(s) shall be constructed from ¼" thick steel.

The following optional features may be specified for the shunt reactor

6.9 A pad lockable, externally operated, under oil disconnect switch.

6.10 Dial-type liquid temperature gauge, liquid level gauge, pressure vacuum gauge, and sudden pressure relief device (PRD) with alarm contacts.

7 Load Interrupter - Air Disconnect Switch

7.1 The shunt reactor bank shall be supplied with an external chain operated load interrupting switch that accomplishes current interruption utilizing a dual arc extinguishing system based on the auto-pneumatic air-blast and hard gas nozzle principle. The switch shall be rated at 135% of the banks nominal current rating and shall have a 40-kA RMS momentary asymmetrical rating. This switch shall be interlocked with the vacuum switches to prevent it from being opened while the filter stage(s) are energized. The switch shall be pad-lockable in either the

open or closed position.

7.2 The Air Disconnect Switch shall be located in a separate compartment that is isolated from the shunt reactor compartment and the low voltage control compartment by a steel barrier. In addition to the exterior enclosure door, a protective screen (behind the door) shall be provided before access to the switch is allowed.

7.3 (Optional – Arc Flash Hazard Mitigation) The air disconnect switch shall be equipped with a motor operator for remote electrical opening and closing.

7.4 (Optional – Arc Flash Hazard Mitigation) The air disconnect switch terminals or shall be equipped with medium voltage indicators that flash when voltage is present.

8 Ground Switch

8.1 An externally operated ground switch shall be provided to ground the load-side terminals of the air disconnect switch. The ground switch shall be pad-lockable in either the open or closed position. The ground switch must be tested in accordance with ANSI/IEEE standards. Test reports shall be furnished upon request.

8.2 The ground switch shall be interlocked with the Air Disconnect Switch to prevent closing of the ground switch when the air disconnect switch is in the closed position.

9 Main Incoming Fuses

9.1 The shunt reactor bank shall be equipped with main incoming current limiting fuses. The fuses shall be located on the load side of the main air-disconnect switch. They shall be accessible only when the bank is de-energized by the main incoming air disconnect switch and shall be completely isolated from any live parts.

10 Shunt Reactor Switches

10.1 The shunt reactor stage(s) shall be controlled by vacuum switches, contactors, or SF6 switches that are suitable for shunt reactor switching. Where necessary, RC snubbers shall be utilized limit high TRV on the switching device and to protect the reactors from switch restrike and re-ignition.

10.2 The shunt reactor switches shall be controlled by an on/off/auto switches. In the auto position, the switches shall accept control from the digital power factor controller (or other type of control when specified). In the on/off position, the switches will be forced on or off, regardless of the controller output signal.

10.3 The reactor switches shall be interlocked with the bank's air-disconnect switch and ground switch.

11 Lightning/Surge Arresters

11.1 The shunt reactor bank shall be equipped with Station Class Lighting Arresters. The rating of the Lightning Arrester shall be recommended by the shunt reactor supplier.

12 Phase and Ground Bus

12.1 All phase and ground bus shall be Tin-plated for maximum conductivity and corrosion resistance. Bolted but-to-bus connections shall be made with 3/8" – 13 stainless-steel bolts with two stainless steel flat washers, one under the bolt head and one under the nut and with a stainless steel split lockwasher between the flat washer and the nut. The bus shall not have a current density greater than 1200 amps/in^2. Where expansion capability is required, the bus shall be rated for the maximum capacity of the bank.

12.2 The bus supports, bus, and interconnections shall withstand the stress associated with the available short-circuit current at the shunt reactor bank.

12.3 (Optional – Arc Flash Hazard Mitigation) All main phase bus shall be insulated with heavy wall anti-track heat shrinkable tubing designed for insulating medium voltage bus bar. Insulation must be tested to ANSI C37.20.2 standards.

13 Interlocks

13.1 The shunt reactor bank shall be equipped with a keyed interlock system to prevent unauthorized and out of sequence entry into the enclosure.

13.2 The interlock scheme shall include the upstream protective device (where necessary), the shunt reactor bank's air disconnect switch, ground switch, and the doors of the enclosure. The interlock scheme shall function as follows:

1) Turn all shunt reactor stage(s) off manually with the on/off/auto switches.
2) Use the "A1" key to unlock the air disconnect switch. Open the Air-Disconnect Switch and close the mechanically interlocked Ground Switch.
3) Remove the "A2" key from the Ground Switch (Removing of the "A2" key shall lock ground switch in closed position" and proceed to the Air-Disconnect Switch External Compartment Door. Unlock the Air-Disconnect Switch Compartment Door and remove the "A3" key from the lock. (Note: Access to Air-Disconnect Switch terminals is prevented by the interior compartment door. This door can be interlocked with upstream breaker or load interrupter if desired. This would prevent access to terminals of switch unless upstream device was locked out.)
4) Use the "A3" key to open the first door that has access to the reactor compartment. Remove the "A4" key from the first reactor compartment door and proceed to the second reactor compartment door.
5) Open the second reactor bank compartment door, and proceed with the released key (if one is present) to the next door.
6) The above procedure is repeated until all doors are open.

13.3 The keyed interlocks on the door shall be mounted behind the enclosure doors with the key-holes protruding through the doors. The locks shall be equipped with stainless steel spring covers. The keyed interlock system shall allow all doors to be opened at one time. Master Key

interchanges or externally mounted key interlocks shall not be provided.

14 Controls

14.1 All low voltage controls (where practical) shall be completely isolated from the high voltage compartments. All controls shall be accessible while the bank is energized. The control compartment shall form an integral part of the enclosure (no externally mounted control compartments shall be allowed). The control compartment shall allow for bottom or top entry of customer control wires without having to enter the medium voltage compartment. The controls compartment shall be equipped with a swing out panel to allow access to panel mounted controls.

14.2 All Control wires that connect to components inside high voltage compartment shall be enclosed in metal conduit or wire troughs that are formed as part of the shunt reactor enclosure.

14.3 The shunt reactor bank shall be equipped with a suitable controller that will automatically switch reactor stages in or out to control voltage (or power factor, var flow, etc.).

14.4 The complete control circuit shall be protected by a main circuit breaker.

14.5 Each stage shall be equipped with on/off/auto switches, stage on indicator (green) and stage off indicator (red).

For Arc Flash Hazard Mitigation, there shall be a 10 second delay before switching when switching from the off to the on position or the on to the off position to allow workers to move outside the arc flash danger zone.

14.6 The bank shall be equipped with a dry-type control power transformer that has both primary and secondary overcurrent protection. The control power transformer shall be connected between phases B and C.

14.7 The Reactor Compartment, Control Compartment, and Air-Disconnect Switch Compartment shall be equipped with lights that are controlled by an on/off switch located in the control compartment.

14.8 (Optional – Arc Flash Hazard Mitigation) The control and protection system shall be remotely mounted from the main equipment enclosure. The remote enclosure shall be NEMA 1 rated for indoor application. All interconnection wiring shall be supplied by the installing contractor. Terminal blocks in the main equipment enclosure shall be located in a marshalling cabinet. Remote I/O blocks may be used when required in the marshalling cabinet.

14.9 (Optional – Arc Flash Hazard Mitigation) The shunt reactor bank shall be equipped with an ABB UFES (Ultra Fast Earthing Switch) that will provide active arc fault protection for the entire reactor bank. The UFES system shall be supplied complete with electronic detection and tripping unit, primary switching element, arc sensors and trip cables. The system shall be installed and ready for operation. A transfer trip must be wired out to terminal blocks for tripping upstream feeder breaker in event of fault.

14.10 (Optional – Arc Flash Hazard Mitigation) The control system shall be equipped with a “maintenance switch” that enables instantaneous settings on the shunt reactor bank feeder breakers (and stage breakers when present) to reduce trip times when workers are near the equipment. The switch shall also inhibit all stage switching to reduce the probability of arc flash

event from switch failure or switch restrike while workers are nearby.

14.11 (Optional – Arc Flash Hazard Mitigation) The shunt reactor bank shall be equipped with an arc flash detection relay that provides high speed tripping of the reactor bank feeder breaker in the event of an arc flash fault. The relay and optics shall be installed and tested at the factor before shipment. The fast trip relay output shall be wired to terminal blocks for connection to reactor bank feeder breaker.

14.12 A 20-amp GFI Convenience outlet shall be provided in the control compartment.

14.13 The Control System shall be listed under UL 508A for Industrial Control Panels.

14.14 UL Rated Control Power Circuit breakers shall be utilized in the control circuit for protection and switching of key control components.

The following optional requirement can be specified as required:

14.15 A three-phase panel meter shall be provided. This meter shall receive its voltage and current signals from three current transformers and two potential transformers located inside the reactor bank. The meter shall be pre-programmed at the factory and shall have the following features:

- Voltage, per phase & average
- Current, per phase & average
- Real Power, per phase & total
- Apparent Power, per phase & total
- Power Factor, per phase and total
- Voltage & Current Unbalance
- Frequency
- Imported, exported, absolute and net kWh & kVARh
- Accumulated kVAh
- Sliding Window, Predicted, & Thermal Demand on kW, kVAR, kVA, & I average
- Minimums and Maximums are stored for Voltage, Current, kW, kVAR, kVA, Power Factor, Frequency, & Sliding Window Demand for kW and kVA
- Individual and Total Harmonic Distortion on Voltage & Current Inputs up to 15th harmonic
- The meter shall have 4 digital outputs that can be wired for relay control based on any of the measured values above.

15 Supplier Quality System

15.1 The supplier shall have third party certification by an internationally recognized accreditation body to the most recent version of the ISO 9001 standard for quality management systems. The certification certificate shall be provided with the quote.

15.2 Supplier shall be authorized to label equipment as compliant with IEEE C37.20.3-2001 “Standard for Metal-Enclosed Switchgear” and C22.2 No. 190-M1985 “Capacitors for Power Factor Correction”. The certification certificate shall be provided with the quote.

15.3 Supplier shall be factory certified through periodic inspection by UL to apply UL and C-UL labels

on their control panels. The certification certificate shall be provided with the quote.

15.4 Supplier shall have on staff, experienced, licensed professional engineers (PE's) with degrees in Power Engineering (preferably with advanced degrees) as evidence of technical proficiency.

15.5 Supplier must provide a medium voltage metal enclosed customer list with contact information for the purpose of reference checks. The customer lists shall be provided with the quote.

15.6 Supplier must allow factory audits to occur at mutually agreed upon dates between the customer and supplier.

16 Submittals

16.1 Upon issue of a purchase order, the supplier shall provide 3 copies of approval drawings. The submittals shall include:

- Installation Instructions
- Single Line and three line diagrams
- Pad and cable entry drawings
- Drawings showing component layout
- Data sheets for all internal components
- Material listing

17 Bid Requirements

17.1 Supplier must provide an Inspection Test Plan (ITP) detailing all tests, tests reports, and certifications and their schedule for submission from date-of-award.

17.2 Supplier must provide a Supplier Document List (SDL) detailing all submittal and close-out documentation that will be provided, along with a submittal schedule (in weeks after award).

17.3 Supplier must state all exceptions in the Bid. If no exceptions are taken, the supplier must state that there are no exceptions.

17.4 Supplier must complete attached supplier qualification form and attach to quote. Failure to provide qualification form with quote will be cause for rejection.

17.5 Supplier must have optional extended warranty and field service agreements available. These policies shall be provided with the bid.

17.6 Supplier must provide their written quality policy with the Bid.

17.7 Quotes are to be FOB factory, freight allowed.

18 Testing and Test Reports

18.1 All components shall be tested in accordance with the relevant standards. Tests to be conducted shall be included in an Inspection Test Plan (ITP), and provided with the bid. At a minimum, the tests included in this section shall be included in the ITP.

18.2 A Power-Frequency Withstand Test and a Lightning-Impulse Withstand Test shall be conducted by the assembler in accordance with IEEE C37.57-2003 (2010), IEEE C37.20.3, and IEEE Std. 4 - 2013. The Test Voltages shall be in accordance with C37.20.3-2013 Table 1. Multiple test shall be conducted to demonstrate insulation levels under various operating modes, i.e. main switch open, main switch closed, capacitor stage switch open, capacitor switch stage close.

18.3 All relays and control devices shall be programmed, tested, and calibrated prior to shipment. The results of the calibration shall be issued with the test report. Relay and control settings shall be documented and included with the equipment installation, commissioning, and maintenance instructions.

18.4 Air Disconnect Switch shall include the following test: Contact Resistance Test, HiPot Test (1 min) at standard voltage per applicable standard, and operation test.

18.5 Lightning Arresters shall include the following test: Reference Voltage, Residual / Discharge Voltage, Partial Discharge Test, Power Frequency Test.

18.6 Instrument Transformers shall include the following: Turns Ratio Test, Polarity Check, Insulation Test, and Excitation Test per IEEE Std. C57.13.

18.7 Capacitors shall include the following test: Leak test, low voltage capacitance test, ground test over-voltage, capacitance and loss measurement, discharge resistor measurement, and visual inspection for damage.

18.8 Southern States CapSwitcher shall include the following test: Hi-Pot Testing, Timing Test, Resistance Check, Heater Wattage Check, SF6 Leak Check, Slow Close Operation Test, Wiring Check, Gas Density Switch Check (when applicable).

18.9 SF6 Circuit Breaker shall include the following test: Mechanical Operation Tests, Power Frequency Voltage Voltage Withstand Test, Contact Resistance Test, Operating Time Test.

18.10 The equipment shall be fully assembled and tested prior to shipment. Certified test reports in accordance with the vendors inspection test plan (ITP) shall be issued and approved prior to shipping.

18.11 The client reserves the right to witness any and all tests performed at no additional cost. Sufficient notification shall be given to allow client's representative(s) to be present for the tests. A minimum of 15 working days shall be allowed.

19 Acceptable Product & Suppliers

19.1 Suppliers must offer a 12/18 month (18 months from date of shipment or 12 from date of energization – whichever comes first) warranty and have available extended warranty

programs.

19.2 Supplier must be able to meet testing requirements.

19.3 The supplier must have a current ISO 9001 certification and be certified by an independent ISO accredited firm. The ISO 9001 certificate shall be provided with the bid.

19.4 Supplier must show that they are a regular supplier of medium voltage automatic metal-enclosed shunt reactor banks. Product literature and a list of customers that have purchased similar products shall be supplied upon request.

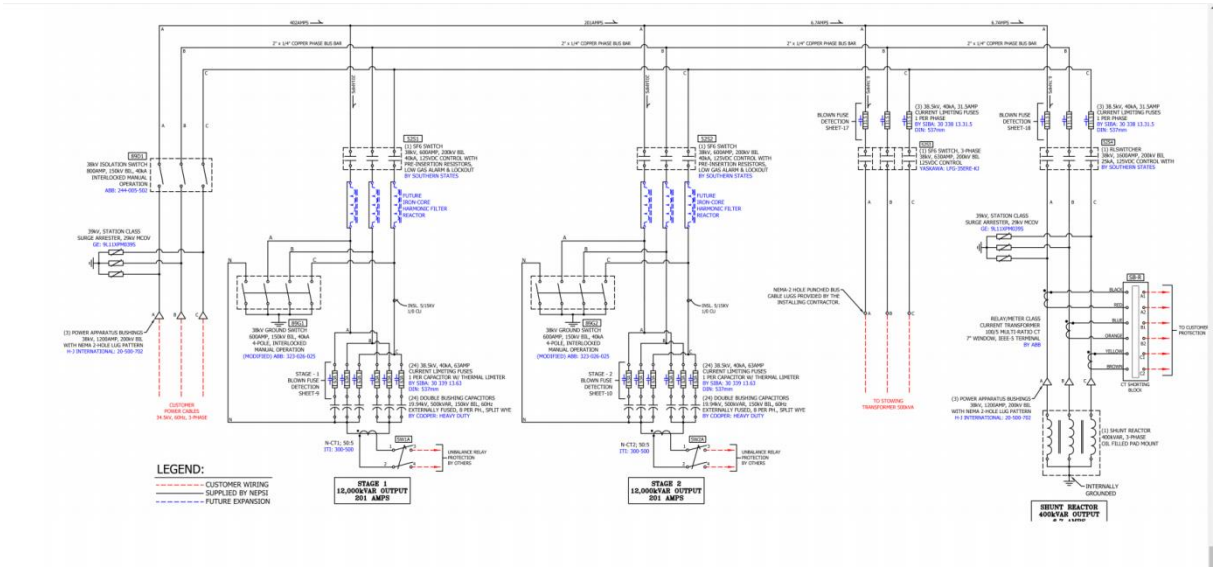
19.5 Acceptable Manufacturer and Product:

Northeast Power Systems, Inc.
66 Carey Road
Queensbury, NY 12804

Phone: 518-792-4776
Fax: 518-792-5767

Webpage: www.nepsi.com
Quote request: sales@nepsi.com

Shunt Reactor Banks can also be equipped with capacitor stages as shown below.



See the following link for further details: Hybrid Shunt Reactor & Shunt Capacitor Compensations Systems.

See the following link for a complete listing of NEPSI guide form specifications:
http://nepsi.com/resources/guide-form-specifications/