**Where showed in the one line diagram the Automatic Transfer Scheme (ATS) should be based on ABB’s Relion Microprocessor Protective relays and provide the following features:**

The ATS Scheme shall take advantage of IEC-61850 GOOSE messages by limiting the number of cross unit wiring between cubicles.

The ATS Scheme shall be based on three relays to provide another level of selectivity for MTM schemes, one relay for each incoming breaker, and one relay for the tie breaker

It shall be possible to operate all breakers via its respective control switch when ATS scheme is in manual mode.

An external lockout relay shall be used to indicate if there is a fault in the bus and to prevent automatic transfer operation

It shall be possible to adjust timers and under voltage settings through the Human Machine Interface (HMI) of the relay.

It shall be possible to adjust timers and under voltage settings through the Web HMI without the need of any external software other than a web browser

To increase the reliability of the GOOSE communications between the devices the Microprocessor relays shall support either HSR or PRP redundancy communications

The ATS shall have 2 selector switches as indicated in the sequence of operations

**The sequence of operations for the ATS scheme would be as follows**

**Selector Switches**

*43 M/A Manual/Auto Switch*

Describes manual or automatic operation for the transfer scheme

*43-10 M1/T/M2 Maintenance Switch*

Only when 43 M/A switch is in "Manual", used to indicate what breaker should be open when all breakers are closed at the same time to perform maintenance operations or to return system to normal when 43R M/A switch is in “Manual”

**Normal Mode of Operation**

The normal mode of operation would be with device 43 in “Automatic” mode, both incoming lines will be normally closed and tie breaker will be open.

**Electrical interlocks**

The two incoming lines are electrically interlocked such that all three breakers cannot be closed at the same time and incoming line breakers cannot be paralleled; unless (DEV 43) is in 'manual' and permitted by synch check function.

In event of the protective relay trip via lockout relay (DEV 86), the opened main and tie cannot be closed until the fault is removed and lockout relay is reset.

**Manual /Maintenance Operation**

It would be possible to perform maintenance to any of the incoming lines. Dev 43 shall be in “Manual”. Device 43/10 will indicate what breaker will be automatically open if both Main breakers and Tie breaker are closed at the same time under manual operation.

*Maintenance of Main 1*

Device 43/10 shall be placed on “Main 1” and device 43 shall be placed in “Manual”.

To perform maintenance on Main 1, close tie breaker subject to electrical interlock above described. Once the tie breakers closes, the Main 1 will be open automatically.

*Maintenance of Main 2*

Device 43/10 shall be placed on “Main 2” and device 43 shall be placed in “Manual”.

To perform maintenance on Main 2, close tie breaker subject to electrical interlock above described. Once the tie breakers closes, the Main 2 will be open automatically.

*Return to Normal*

To return the system to normal conditions with both Main breakers closed and tie breaker open. With device 43 in “Manual” mode, place device 43/10 on “Tie”, and then closed the opened incoming line subject to electrical above. As soon as the opened incoming line is closed and all three breakers are closed at the same time, Tie breaker will be open automatically.

**Automatic mode - (selector switch (DEV 43) in 'automatic')**

(a)

Loss of voltage on either incoming line will, after a time delay, causes its main breaker to open and then the tie breaker will close provided that voltage is present on the other incoming line. When the voltage is restored, the system will be restored to normal operation manually. Refer to manual operation. However, if while waiting for manual restoration, the incoming line powering the load loses power, the failed incoming line will open and then the healthy incoming line will close provided that it has been healthy for the time.

(b)

However, if the voltage is subsequently lost on the second line after the transfer has occurred as described in (a) above, the second line will stay close leaving the tie breaker close. Return of voltage to the open incoming line first will cause, the closed incoming line to open and then the open incoming line will close. Return of voltage to the closed incoming line first will not cause any operation leaving the closed incoming line close and the open incoming line open. Simultaneous restoration of both sources will not cause any operation leaving the closed incoming line close and the open incoming line open.

(c)

Simultaneous loss of both sources will not cause any operation, leaving both incoming lines closed and tie breaker open.

(d)

Simultaneous restoration of both sources, after both sources were lost at the same time will not cause any operation, leaving both incoming lines close and tie breaker open.

**Bill of Material**

43 M/A Manual/Auto switch

43/10 M1/T/M2 Maintenance switch

(3) Lockout Relays

(2) REF615 Ordering Code: HAFDDADAFHE5BBN12E for the Mains

1. REF615 Ordering Code: HAFFFAFAFHE5BBN12E for the Tie
2. Ethernet Switch\*