

GP 16-12-03	Secondary-Selective Substations with Time-Based Automatic Transfer	July 2003
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Secondary-Selective Substations with Time-Based Automatic Transfer

GP 16-12-03

Scope

[I] This Global Practice (GP) covers the electrical control requirements for secondary-selective substations with time-based automatic transfer using normally open bus-tie breakers that supply power to existing plants that have similar time-based transfer systems. The requirements of [GP 16-12-02](#) shall apply in all other circumstances.

[I] An asterisk (*) indicates that a decision by Purchaser is required or that additional information is furnished by Purchaser.

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1. Design

1.1. AC/DC Voltage

- 1) * [I] Secondary-selective system control shall be connected in accordance with Figures 1 through 4 when direct current (DC) control voltage is supplied, and in accordance with Figures 5 through 8 when alternating current (AC) control voltage is supplied. The AC control scheme shown in Figures 5 through 8 shall be limited to low-voltage circuit breakers using static trip devices with a self-contained power supply for reliable tripping.
- 2) * [R] When DC voltage is obtained from batteries and used for control in medium-voltage switchgear, this DC supply shall also be used for secondary-selective system control of low-voltage switchgear located in the same general area.

1.2. Breakers

- 1) [O] Electrically operated breakers shall have a quick-close mechanism to provide a closing time of approximately 0.1 second.
- 2) [O], [R] Under normal conditions, secondary-selective systems shall operate with the bus-tie circuit breaker open and with normally closed main breakers.
- 3) [O], [M] Manual trip operation of either incoming line circuit breaker of the secondary-selective system by means of the mechanical trip device or the breaker control switch shall not initiate the automatic closure of the bus-tie circuit breaker.
- 4) [O], [M] Automatic operation of the secondary-selective system control shall be locked out until the incoming line and bus-tie drawout circuit breakers are fully installed in the connected position.

1.3. Control of Main/Secondary Lines

- 1) [O], [M] A selector switch with the necessary controls shall be provided to allow an incoming line from one bus section to be disconnected and the load transferred to the other bus section. This switch, when used in conjunction with control relays and individual circuit breaker control switches, will permit the bus-tie breaker to be closed and a main incoming line breaker to be opened without loss of power on either secondary bus of the system. The control scheme shall also permit closing of the main incoming line circuit breaker and tripping of the bus-tie breaker without loss of power. In both cases, there will be a momentary parallel operation of the two incoming secondary lines.
- 2) [O], [R] Normally, the two incoming line sources are in synchronism. Where at times these sources may not be synchronized, a synchronism-check relay and auxiliary relays, or other means, shall be provided to:
 - a) Prevent manual parallel operation when the sources are not synchronized.
 - b) Energize the sync-check relay when the breaker control switches are operated.
 - c) Permit breaker closure by control switch when any two breakers are open.

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- 3) [O], [R] Manual operation of the main incoming line and bus-tie circuit breakers shall be provided to allow for nonparallel (open-transition) transfer operation of the two incoming secondary lines when the line sources are not in synchronism.
- 4) [R], [M] A separate and individually protected control circuit shall be supplied to each incoming and bus-tie circuit breaker, whether the control potential is AC or DC.

1.4. System Control Operation

- 1) [R], [M] For a full understanding of the secondary-selective system controls, Table 1, Table 2, and Figures 1 through 4 or Figures 5 through 8, shall be used in conjunction with the following description of operation:
 - a) Loss of voltage for a predetermined period of time on either Circuit No. 1 or Circuit No. 2 shall cause Incoming Breaker 52-1 or 52-2 to open and Bus-Tie Breaker 24 to close. This will restore voltage on the de-energized bus section, unless there is a fault on the downstream bus. Normally, Relay 27X is set for two seconds. One additional second shall be added when the source system is another secondary-selective system.
 - b) Upon loss of voltage on both Circuit No. 1 and Circuit No. 2, Incoming Breakers 52-1 and 52-2 shall remain closed and Bus-Tie Breaker 24 shall remain open, provided the loss of voltage is not caused by a fault downstream of the breakers.
 - c) Overcurrent Relays 50-1 and 50-2 have been incorporated into the control circuitry to prevent operation in the event of loss of voltage due to a downstream fault. The instantaneous trips on these relays block the operations noted above until the short circuit is cleared from the system.
 - d) Incoming Breaker 52-1 or 52-2 shall open if outgoing feeder breakers do not clear downstream faults. Bus-Tie Breaker 24 shall remain open and the control system shall be automatically locked out through Lockout Relay 86-1 or 86-2.
 - e) Bus-Tie Breaker 24 shall remain open if either Incoming Breaker 52-1 or 52-2 is opened by its mechanical trip device or breaker control switch.
 - f) Automatic and manual transfer operation shall be prevented by Circuit Breaker Limit Switches 52-1/LS, 52-2/LS, and 24/LS until Incoming Breakers 52-1 and 52-2 and Bus-Tie Breaker 24 are in the connected position.
 - g) Selector Switch 10 permits momentary parallel operation of Incoming Breakers 52-1 and 52-2 in order to transfer the load between the buses without loss of voltage. Selector Switch 10, placed in either the TRIP 52-1 BREAKER or TRIP 52-2 BREAKER position, permits Breaker Control Switch 24CS to close Bus-Tie Breaker 24. Upon closure of Bus-Tie Breaker 24, breaker-operated Auxiliary Switch 24/a automatically opens the selected incoming line circuit breaker. Selector Switch 10, placed in the TRIP BUS-TIE BREAKER position, permits the incoming breaker, which is open, to be closed by its breaker control switch. On closure of the incoming breaker, the associated breaker-operated auxiliary switch automatically opens Bus-Tie Breaker 24.
 - h) After an automatic operation, which results from an abnormal condition, the incoming and bus-tie breakers shall be manually restored to the normal operation position by means of Incoming Breaker Control Switches 52CS-1 and 52CS-2 and Selector Switch 10, as required.
 - i) Loss of control power shall not initiate an automatic transfer.
- 2) [R], [M] The Overcurrent Trip Switches 51-1/TS and 51-2/TS shall function only when the static trip device operates on an overcurrent and shall be hand reset.

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Table 1: Legend for Figures 1 through 8

Devices	
10	Selector Switch
24	Bus-Tie Circuit Breaker
25	Sync-check Relay
25X, Y	Auxiliary Sync-check Relays
27	Instantaneous AC Undervoltage Relay
27X	Auxiliary Undervoltage Relay (Time-delay pickup of 0-5 seconds and instantaneous dropout)
50	AC Instantaneous Overcurrent Relay
51	AC Time-Overcurrent Relay
51G	AC Time-Overcurrent Ground Relay
52	Incoming Circuit Breaker
63	Sudden Pressure Relay
83	Transfer Relay
86	Line Lockout Relay, Hand Reset
86P	Transformer Lockout Relay, Hand Reset
87	Differential Protective Relay
Subscripts	
$\bar{a}$	Circuit Breaker Auxiliary Contact, Normally Open
$\bar{b}$	Circuit Breaker Auxiliary Contact, Normally Closed
$\overline{LS}$	Circuit Breaker Limit Switch
$\overline{TDC}$	Time Delay to Close
$\bar{6}$	Device Contact Number
$\overline{TS}$	Trip Switch, Hand Set
Abbreviations	
CT	Current Transformer(s)
VT	Voltage Transformer(s)
CPT	Control Power Transformer
NO	Normally Open

Suffixes	
CS	Control Switch
-1	Circuit No. 1
-2	Circuit No. 2
N	Neutral or Residual

Table 2: Symbols used in Figures 1 through 8



Normally Open Contact



Normally Closed Contact



Fuse

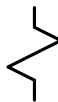


Position Indicating Light, Resistor Type:

R = Red Light
A = Amber Light
W = White Light
G = Green Light



Air Circuit Breaker



Operating Coil



Switch:

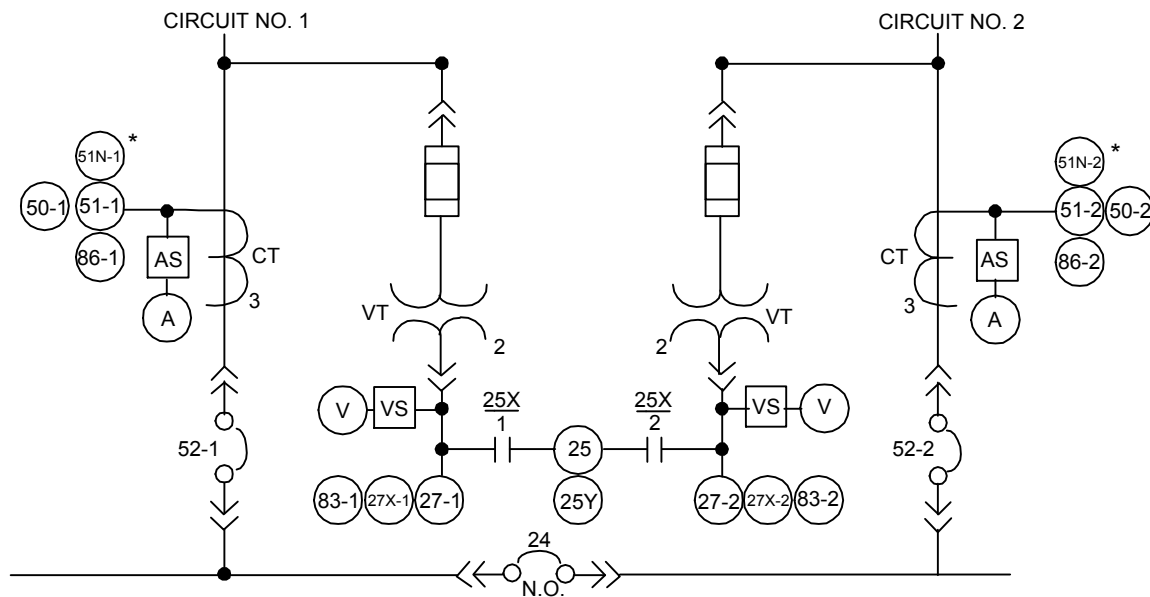
AS = Ammeter Switch
VS = Voltmeter Switch

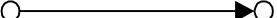
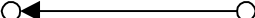


Meter or Device:

A = Ammeter
V = Voltmeter
51 = Typical Device Number

Figure 1: Secondary-Selective System Using DC Control Single-Line Diagram and Switch Developments



CONTROL SWITCHES 24CS AND 52CS				
CONTACT NUMBER	CLOSE	NORMAL AFTER CLOSE	NORMAL AFTER TRIP	TRIP
1	X			
2	X	X		
3				X
Spring Return				
X - Denotes contact closed				

SELECTOR SWITCH 10			
CONTACT NUMBER	POSITION 1 TRIP 52-1 BREAKER	POSITION 0 TRIP TIE BREAKER	POSITION 2 TRIP 52-2 BREAKER
1		X	X
2	X		
3	X		X
4		X	
5	X	X	
6			X
Position 0 - Normal position			
X - Denotes contact closed			

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