



SPECIALTY SWITCHES



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The **LineBOSS™ NBS**, Nielsen Bypass Switch, was originally designed in 1972 by Carl Nielsen, P.E. to allow non-interrupting bypassing and energizing (cut-in or cut-out) fixed booster transformers. The NBS switch now provides continuous power to load-side customers when energizing or de-energizing one, two, or three phase fixed booster, auto-booster and regulator transformers as required by voltage conditions or for routine maintenance or replacement.

The conventional combination bypass-disconnect switch used for de-energizing multi-step regulators; first requires the regulator be placed in the neutral position. As the switch opens, a shorting bar is inserted across the main line leads and the regulator series winding. If the regulator tap changing mechanism or the position indicator has malfunctioned and the regulator is not in the neutral position, attempting a by-pass operation can result in excessively high circulating current in the series winding which can damage or destroy the series tap changer mechanism, the switchgear, bus work and endanger personnel.

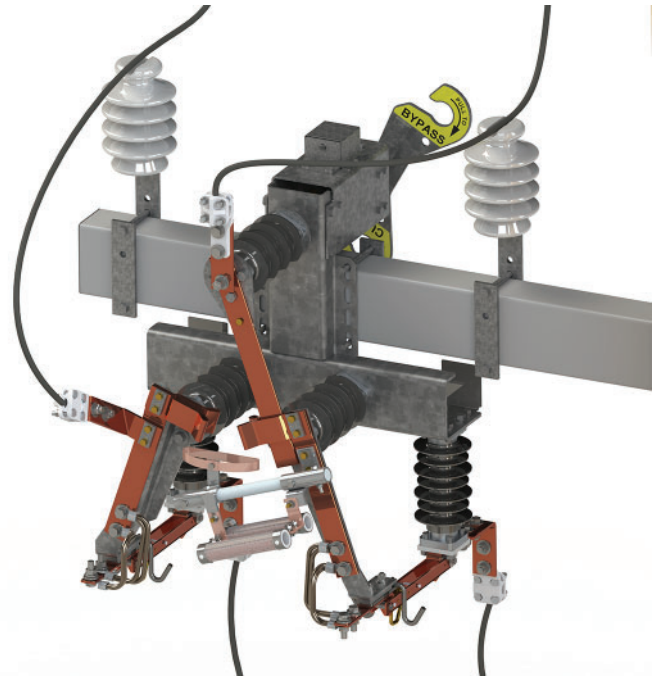
The NBS bypass switch eliminates this safety hazard by controlling the series winding circulating current by use of a current limiting resistor, while providing uninterrupted service to load side customers. The transfer series resistor assembly permits bypassing multi-step regulators in the buck or boost position (refer to application calculations).

TYPICAL APPLICATION:

Cut in a 762 kVA (7620 V, 100 A), single-phase regulator to boost the voltage. The regulator indicates that it is in neutral, but it is actually at step one. The circulating current could be as high as 31 kA during the switching operation using a standard combination bypass disconnect switch. The NBS switch, with its current limiting series resistor assembly, limits the circulating current to less than 24 A without interruption of service.

THE TWIN FEED NBS:

The NBS-2D is designed for use on fixed boosters and auto-boosters that are on circuits that have preferred and alternate source directions. The NBS-2D allows the booster or auto-booster to boost in the direction of the load when the alternate source is being utilized. The NBS-2D provides a switching method for re-routing the source feed to the booster transformer without re-wiring the buswork. The NBS-2D is not required on multi-step regulators.



STANDARD FEATURES

- Unitized or modular construction on aluminum or steel crossarms for fast and easy installations.
- Factory adjusted, ready to mount with minimal, if any, field assembly required.
- Available with silicone (std.) or porcelain insulators.
- Reverse loop, silver plated copper jaw contacts.
- Maintenance-free, sealed, stainless steel ball bearings.
- Meets all applicable NEMA and ANSI standards.
- All ferrous components are hot dip galvanized.
- Tinned copper two-hole and four-hole terminal pads

SWITCH RATINGS:

Voltage Class: 5 kV, 15.5 kV, 25.8 kV & 38 kV
Continuous Current Class: 600 A Transfer & Continuous

STANDARD CONFIGURATIONS

- Single-pole units, unitized, reciprocating handle
- Double-pole unit, unitized, reciprocating handle
- Double-pole unit, two-way feed, unitized
- Three-pole unit, unitized, reciprocating handle
- Single-pole, pole mounted (direct to pole), hookstick
- Single-pole, substation (double crossarm) mounted
- Twist-Assist™ hookstick operated, direct to pole

LineBOSS™ NBS Selection Guide

Non-Interrupting Bypass Switch = N → **N16SQS11222S**
 ARMORGALV® = NT

Voltage Class: 15.5 kV (110 kV BIL) = 1
 25.8 kV (150 kV BIL) = 2
 38.0 kV (200 kV BIL) = 3

Current Rating: 600 A = 6
 900 A¹ = 6
 900 A² = 9
 1200 A = 1
**Switching Current Limited to 600A.*

Insulator Type:
 Polymeric Silicone (3.0" BC) = S
 Porcelain (3.0" BC) = P

Interrupter Type:
 Amrupter, Loadbreak³ = L
 ArcWhip, Quick-break³ = Q
 Dual Amrupter, Loadbreak = 1
 Dual ArcWhip, Quick-break = 2
 No Interrupter = X

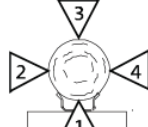
Crossarm Type:
 Aluminum = A
 Fiberglass = F
 Galv. Steel = S ("SX" for Heavy Duty Arm)
 No Xarm = X
Customer specified loading (call factory).

Mounting Configuration:
 Single Phase (10 ft. Crossarm)⁴ = 1
 Two Phase (10 ft. Crossarm) = 2
 Three Phase (10 ft. Crossarm) = 3
 Single Phase (76 in. Crossarm)⁴ = 4
 Two Phase (H-Frame)⁵ = 5
 Three Phase (H-Frame)⁵ = 6

Options:
 Terminals (Specify) = S
 Double Crossarm Base = T
For others call factory or see Options Chart for a complete listing.

Control Rod Length:
 20 ft. (Standard) = 2
 Specify (10' Sections) = __
See Options Chart for insulated section.

Control Location:
 Specify the quadrant by number, where the control is to be located.
See Control Options Chart.

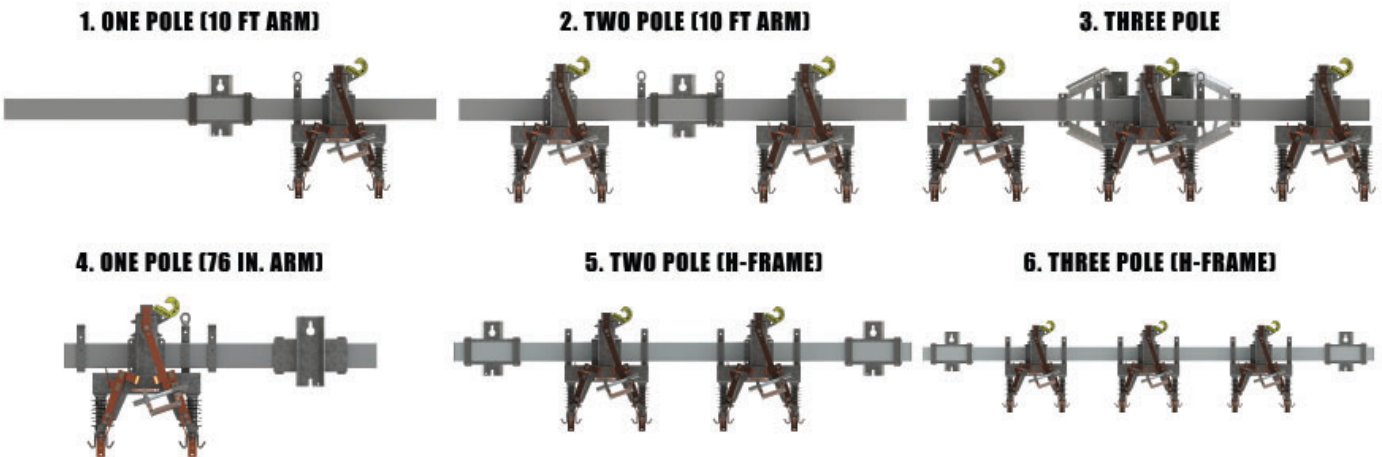


Control Rod Type:
 Reciprocating (⤴) = 2
 1" Round Fiberglass = 2
 3/4" Galvanized Pipe = 3
 Torsional (∩) = 6
 1 1/2" Galvanized pipe = 6

Control Mechanism:
 Reciprocating Handle (⤴) = 1
 Torsional Handle (∩) = 2
 Hookstick (Twist Assist) = 3
Add "C" for counter-clockwise to open.

¹ 900 A (Temp Rise: 30°C Momentary: 40 kA)
² 900 A (Temp Rise: 30°C Momentary: 51 kA ANSI)
³ Source side only.
⁴ Right side mounting is standard unless otherwise specified in options.
⁵ Specify structure dimensions.

LineBOSS™ Standard Configurations



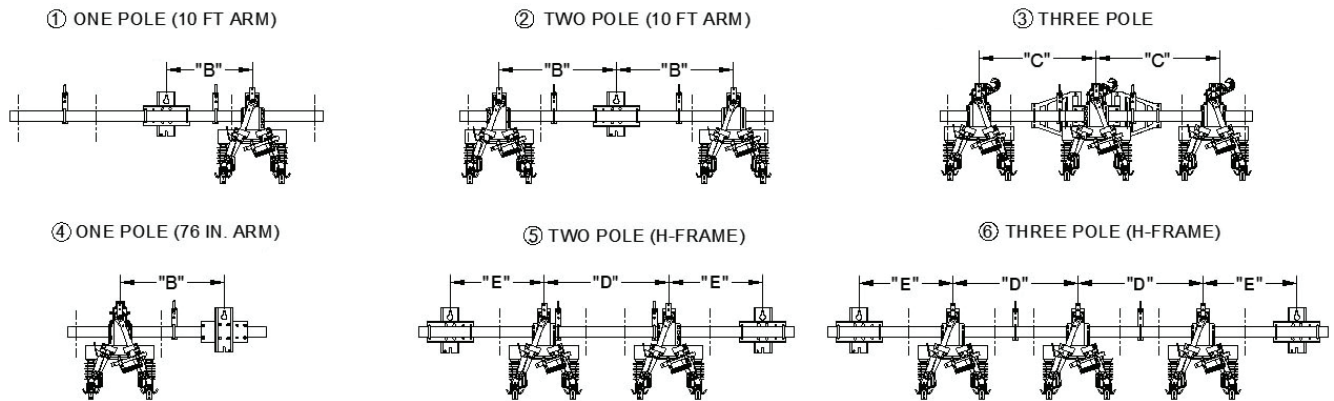


Company Name _____
Address 1 _____
Address 2 _____
City _____ State _____ Zip code _____

Contact Name _____
Telephone Number _____
Facsimile Number _____
E-mail address _____

Make copies of this form to transmit your switch requirements. If you have a standard's drawing, please send it along with this fax form.

- Step 1. Voltage Class: 15kV 25kV 38kV
 Step 2. Continuous current rating: 600A 900A 1200A
 Step 3. Insulator type: Silicone Porcelain
 Step 4. Interrupter type: ArcWhip (Default) AmpRupter™ Dual AmpRupter™ Dual ArcWhip None
 Step 5. Crossarm type: None Galvanized Steel Fiberglass Aluminum
 Step 6. Select the configuration (circle one):



Voltage Class [kV]:	Dim. "B"	Dim. "C"	Dim. "D"	Dim. "E"
15	31	41	38	27.5
25	33	44	44	30.5
35	36	49.5	50	36.5

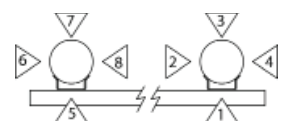
- Step 7. Select Spacing:
 Standard Custom (Fill in Spacing Dimensions below using Table 1 and configurations in Step 6.)
 "B" _____ "C" _____ "D" _____ "E" _____

- Step 8. Select control mechanism:
 Hookstick Reciprocating (↑↓) Torsional (∪)

- Step 9. Select control rod: Galvanized pipe: 3/4" IPS galv. Pipe Fiberglass: 1" round

- Step 10. Select control rod location (See Fig.1): _____

- Step 11. Select control rod length: 10 ft. 20 ft. Other



Step 12. Select additional accessories and modifications: (check off and write in)

- Source & Load Solid Blade Disconnects: Yes (Default) No
- Load/Source Disconnect Position (See Fig. 2): CW (Default) CCW N/A

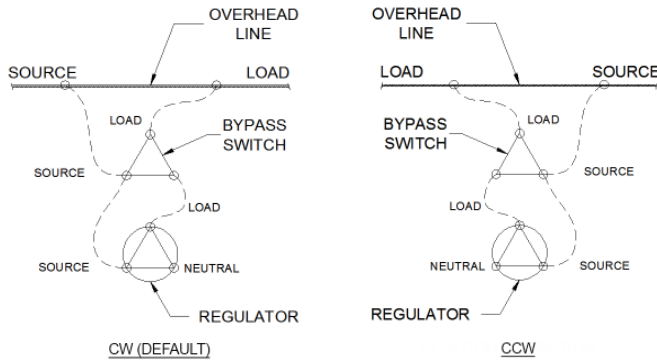


Figure 2: NBS Connection Diagram

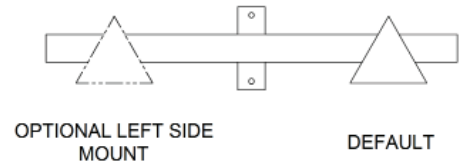


Figure 3: Mounting Side Options

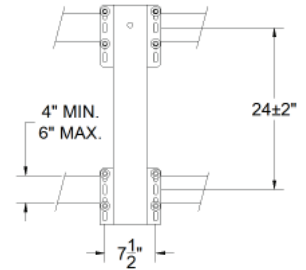
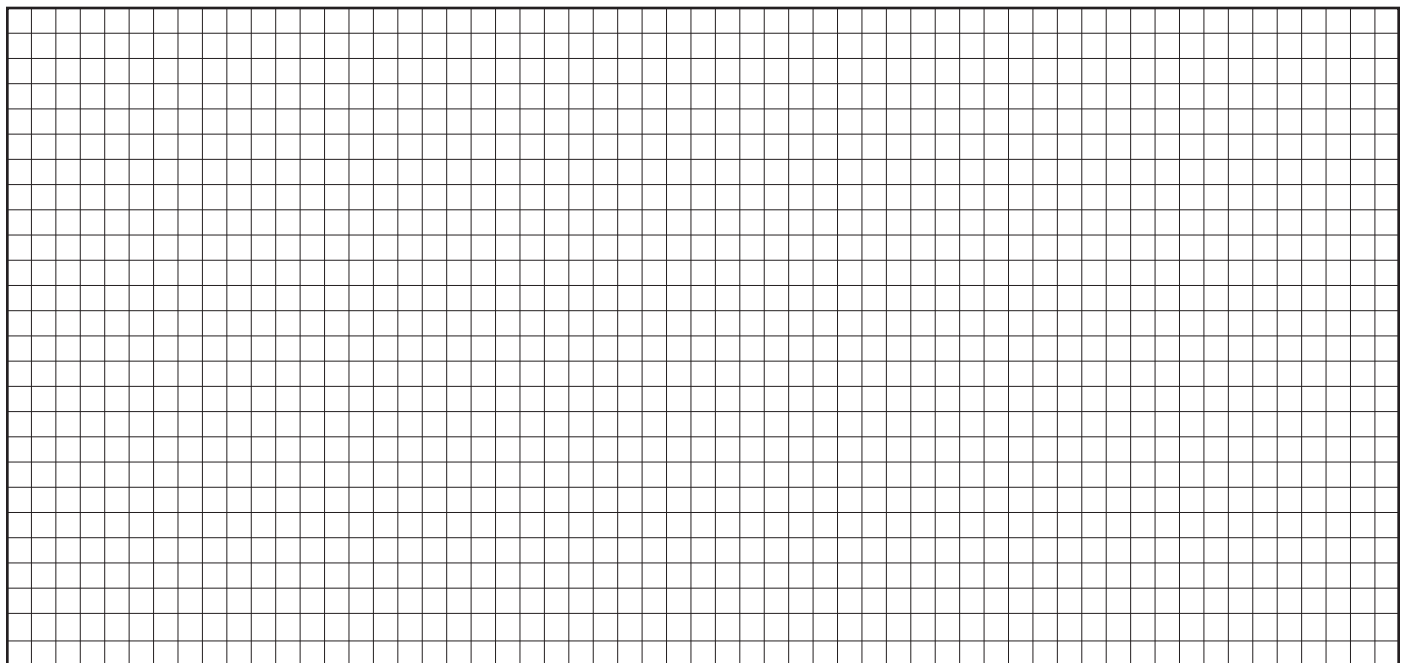


Figure 4: Double Crossarm Base

- Left side phase mounting (Available on Configuration 1 & 4 only, see Fig. 3)
- Double crossarm base (See Fig. 4).
- Pole mounting bands; Specify pole diameter range: _____
- Substation mounting: Specify base mounting dimensions or furnish drawing.
- Terminals: Terminal paddle for fired wedge connectors _____ (specify size)
 - Terminals, 2-hole copper NEMA pad #2-500 kcmil (600 & 900 A switch) Specify: _____
 - Terminals, 4-hole copper NEMA pad 500-750 kcmil (1200 A switch) Specify: _____
 - Terminals, other; _____ (specify size)
- Crossarm Braces: Galvanized Steel Fiberglass
- Grounding connector on crossarm, AWG range # 6 - 4/0 diameter
- Bonded handle
- ArmorGalv® AG3000 (Thermal Diffusion Galvanizing) ferrous component coating¹.

¹Ferrous components come Hot Dipped Galvanized (HDG) standard. Armorgalv AG3000 Thermal Diffusion Galvanizing (TDG) offers increased corrosion resistance.





LineBOSS™

NBS NON-INTERRUPTING REGULATOR/BY-PASS SWITCH

APPLICATION GUIDELINES

Using a standard combination bypass disconnect switch, the voltage differential across the series winding in the regulator is shorted out during the switching sequence. This produces an extremely high circulating current when in the lower tap positions (not in neutral).

The INERTIA NBS eliminates this high current by placing resistance in series with the regulator series winding. The maximum boost or buck voltage differential is limited to 1200 volts (600 A rating x 2 ohms).

The maximum switching position for a given regulator can be determined by the calculations shown:

1. Determine the voltage change per step of the regulator or booster transformer:

$$\text{Voltage Change/Step} = \frac{(\text{Line Voltage}) * (\text{max. boost or buck \%})}{\# \text{ of tap positions}}$$

2. Determine maximum boost or buck tap position:

$$\text{Maximum Tap Positions} = \frac{1,200 \text{ Volts}}{\text{Voltage change per tap}}$$

3. Determine maximum current at tap position 1:

$$\text{Max. Circulating Current} = \frac{(\text{Voltage Change/Step}) * (\# \text{ of tap positions})}{\text{NBS switched series resistance}}$$

Example: Line voltage is 13,800 volts, 10% max. boost or buck with 16 positions boost or 16 positions buck.

$$\frac{13,800 \text{ V} * 0.10}{16 \text{ tap positions}} = 86.25 \text{ Voltage Change per Tap Position}$$

$$\frac{1,200 \text{ Volts}}{86.25 \text{ Volts/tap position}} = 13.9 \text{ Tap Positions}$$

$$\frac{86.25 \text{ Volts} * 1 \text{ tap position}}{2 \text{ Ohms (NBS Resistance)}} = 43.1 \text{ A Max. Circulating Current}$$

Conclusion: The NBS will safely switch this 13,800 V regulator at tap position 13. At step one, where the circulating could be as high as 43,125 Amps based on 0.002 Ohms series winding impedance, the current is mitigated to 43.1 amps while switching.

*****NOTE: Always attempt to return the regulator to neutral before switching. This device is not intended to change the safety or standard operating practice of switching regulators.**

The NBS switch allows an added margin of safety when switching regulators. When neutral position can not be definitely confirmed, the NBS will allow safe switching in the “off-neutral” position as long as the differential voltage across the transformer series winding does not exceed 1,200 V.

INERTIA's NBS, Non-Interrupting Bypass Switch, protects personnel and equipment, and eliminates the downtime and other costs associated with taking an outage to switch regulators, fixed or auto-booster transformers. It provides additional personnel and equipment safety in line distribution and substation applications.

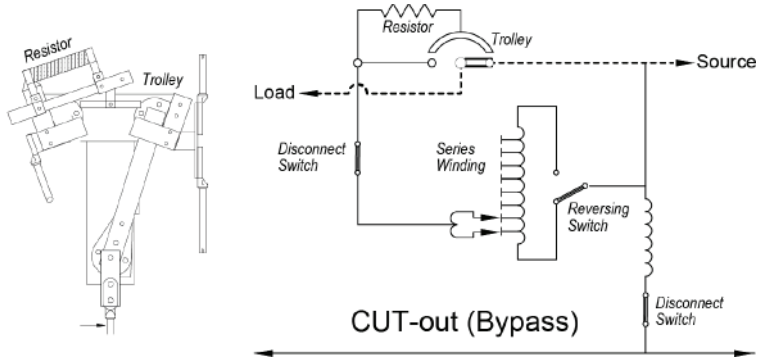


LineBOSS™

NBS NON-INTERRUPTING REGULATOR/BY-PASS SWITCH

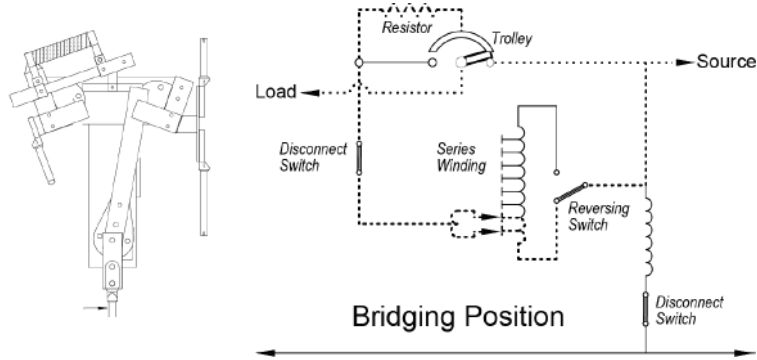
OPERATING SEQUENCES

BYPASS POSITION



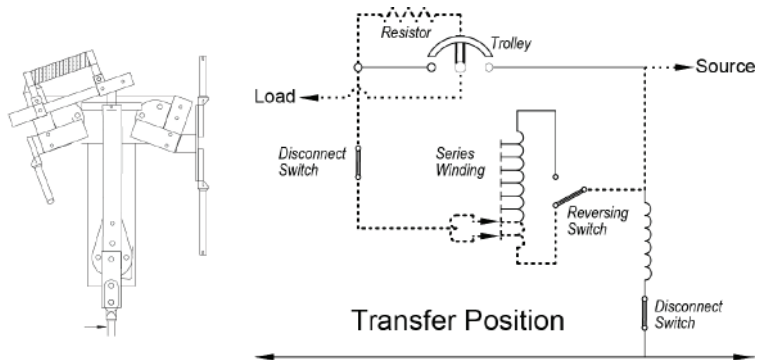
The NBS bypass switch is shown here in the Cut-out or bypass position. The current path is indicated by the dotted line. The regulator is out of the circuit. The actual switch position is shown to the immediate left, while the schematic shows the NBS in the top left of the schematic.

BRIDGING POSITION



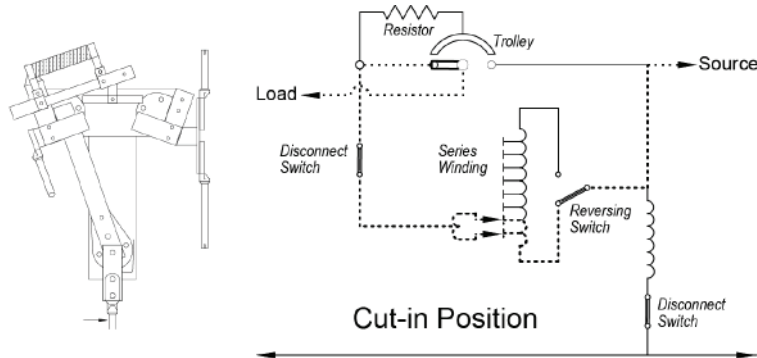
The NBS bypass switch is shown here in the bridging position. Notice that the blade is in contact with the bridging contact before breaking contact with the female clip. The impedance of the series winding and the NBS current limiting resistors eliminate the high circulating current in the series winding. The bridged connection between bridging contact and the female clip insures uninterrupted service.

INTERMEDIATE POSITION



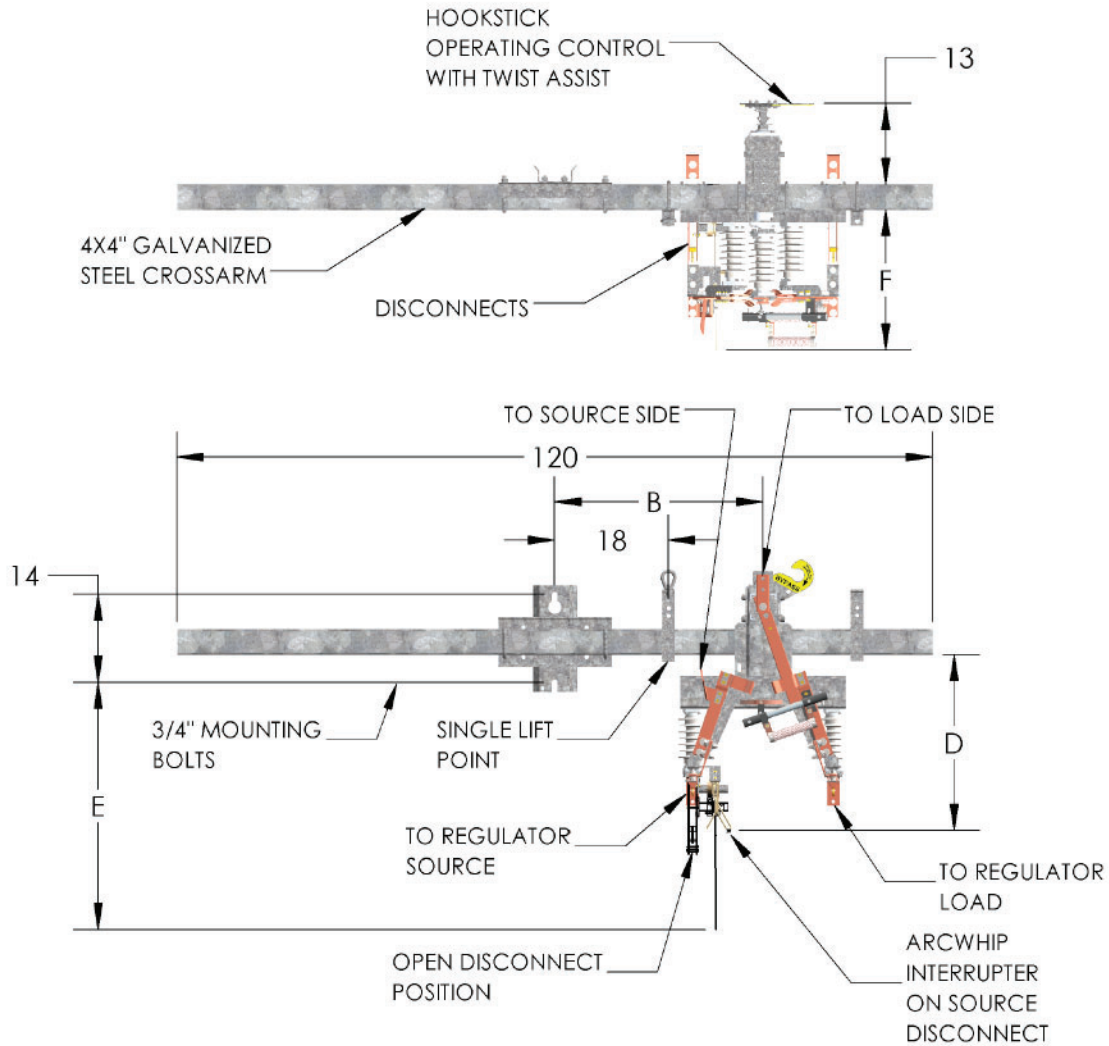
The NBS bypass switch is shown here in the intermediate position. Notice that the blade is in contact with the bridging contact, only. The impedance of the NBS current limiting resistors solely eliminates the high circulating current in the series winding. These resistors are lab and field proven to withstand 600 Amps during the transfer operation.

CUT-IN POSITION



The NBS bypass switch is shown here with the regulator now in service. The blade contacts the female clip while still on the bridging contact. This provides uninterrupted service to the customer. Interruption of voltage can cause magnetic contactors in large motors to drop out, thus requiring restarts.


15 - 38 kV NBS One Pole 10' Arm Dimensions



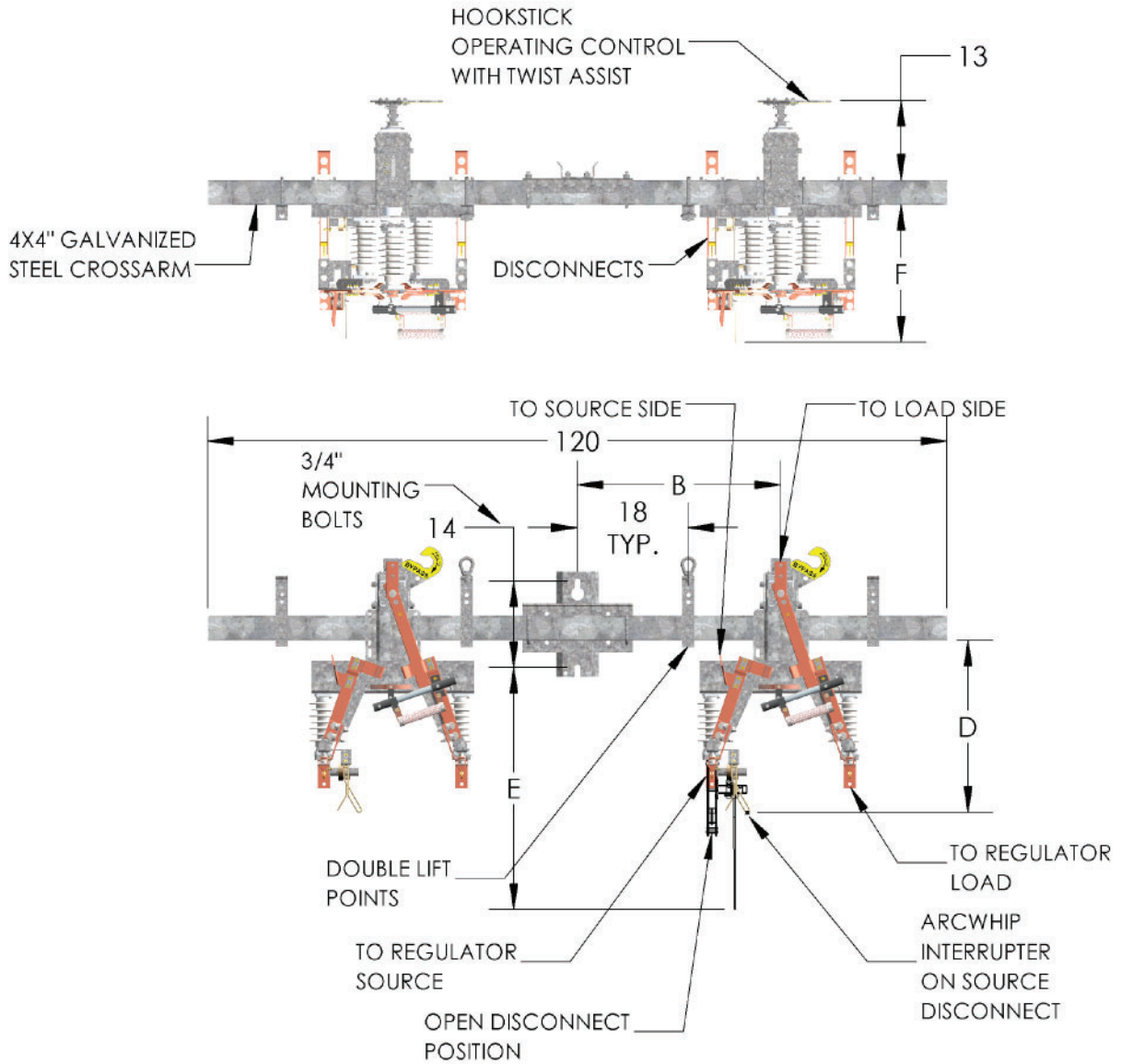
kV	B	D	E	F
15	31	28	39	22
25	33	32	43	26
38	36	36	47	30

MINIMUM DIMENSIONS

This drawing is for illustrative purposes only and therefore; may, or may not reflect the current revision of this drawing. Please request the current revision from the factory upon quote.

	Materials: N/A	Description: NBS, 15 - 38 kV, One Pole (10' Arm), Hookstick Dimensions	
	Finish: N/A		
	Scale: NTS		
	Drawn By: N/A	Drawing No.: 9216-47R-2M	Revision: 00
	Date: N/A		


15 - 38 kV NBS Two Pole Dimensions



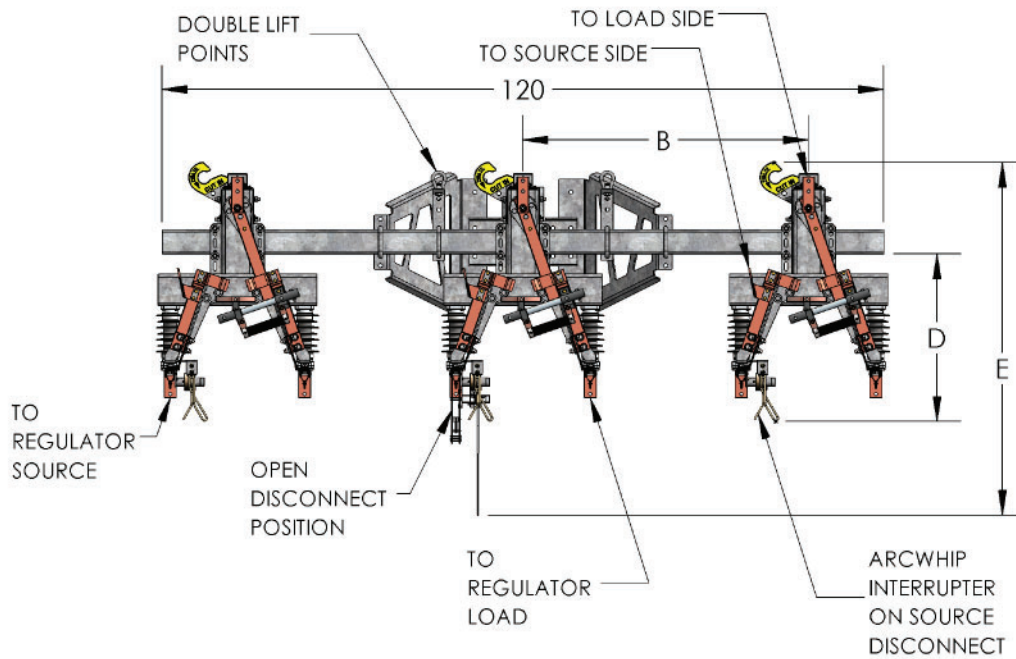
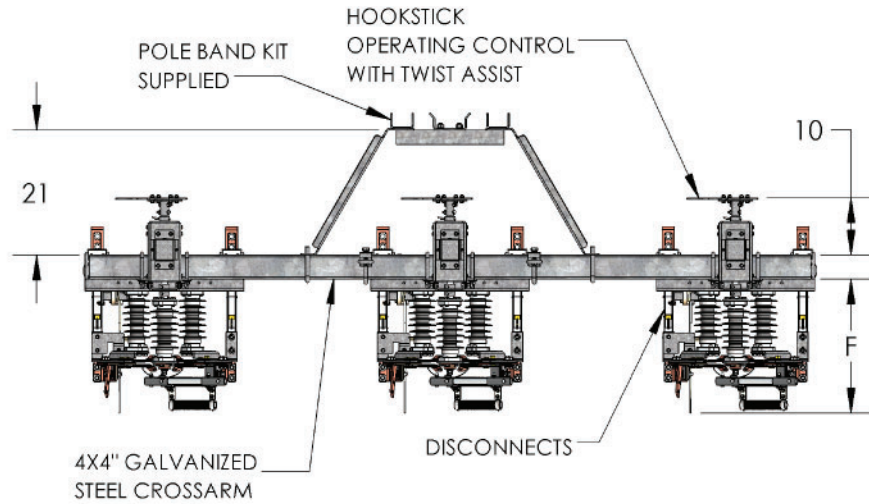
kV	B	D	E	F
15	31	28	39	22
25	33	32	43	26
38	36	36	47	30

MINIMUM DIMENSIONS

This drawing is for illustrative purposes only and therefore; may, or may not reflect the current revision of this drawing. Please request the current revision from the factory upon quote.

	Materials: N/A	Description: NBS, 15 - 38 kV, Two Pole (10' Arm), Hookstick Dimensions	
	Finish: N/A		
	Scale: NTS		
	Drawn By: N/A	Drawing No.: 9216-48-1M	Revision: 00
	Date: N/A		


15 - 38 kV NBS Three Pole Dimensions



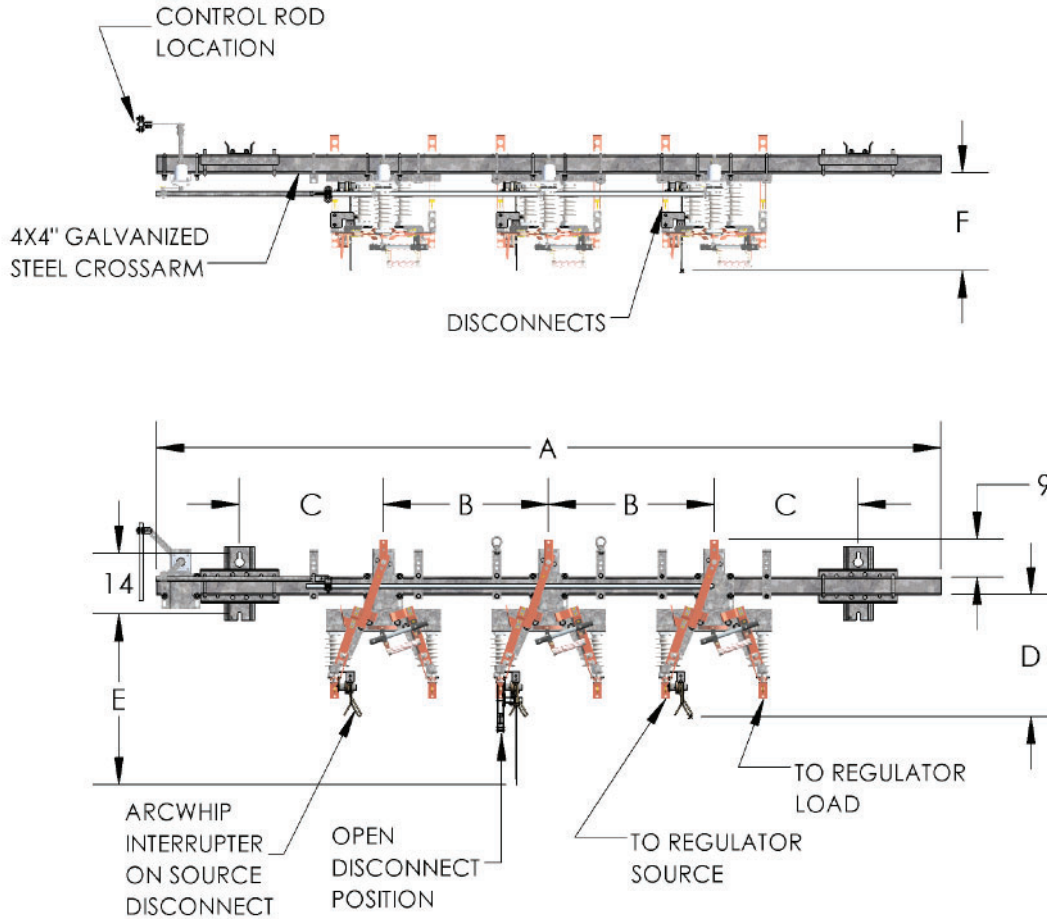
kV	B	D	E	F
15	41	28	59	22
25	44	34	63	26
38	49.5	38	67	30

MINIMUM DIMENSIONS

This drawing is for illustrative purposes only and therefore; may, or may not reflect the current revision of this drawing. Please request the current revision from the factory upon quote.

	Materials: N/A	Description: NBS, 15 - 38 kV, Three Pole, Hook-stick Dimensions	
	Finish: N/A		
	Scale: NTS		
	Drawn By: N/A	Drawing No.: 9216-51M	Revision: 00
	Date: N/A		


15 - 38 kV NBS Three Pole H-Frame Recip. Dimensions



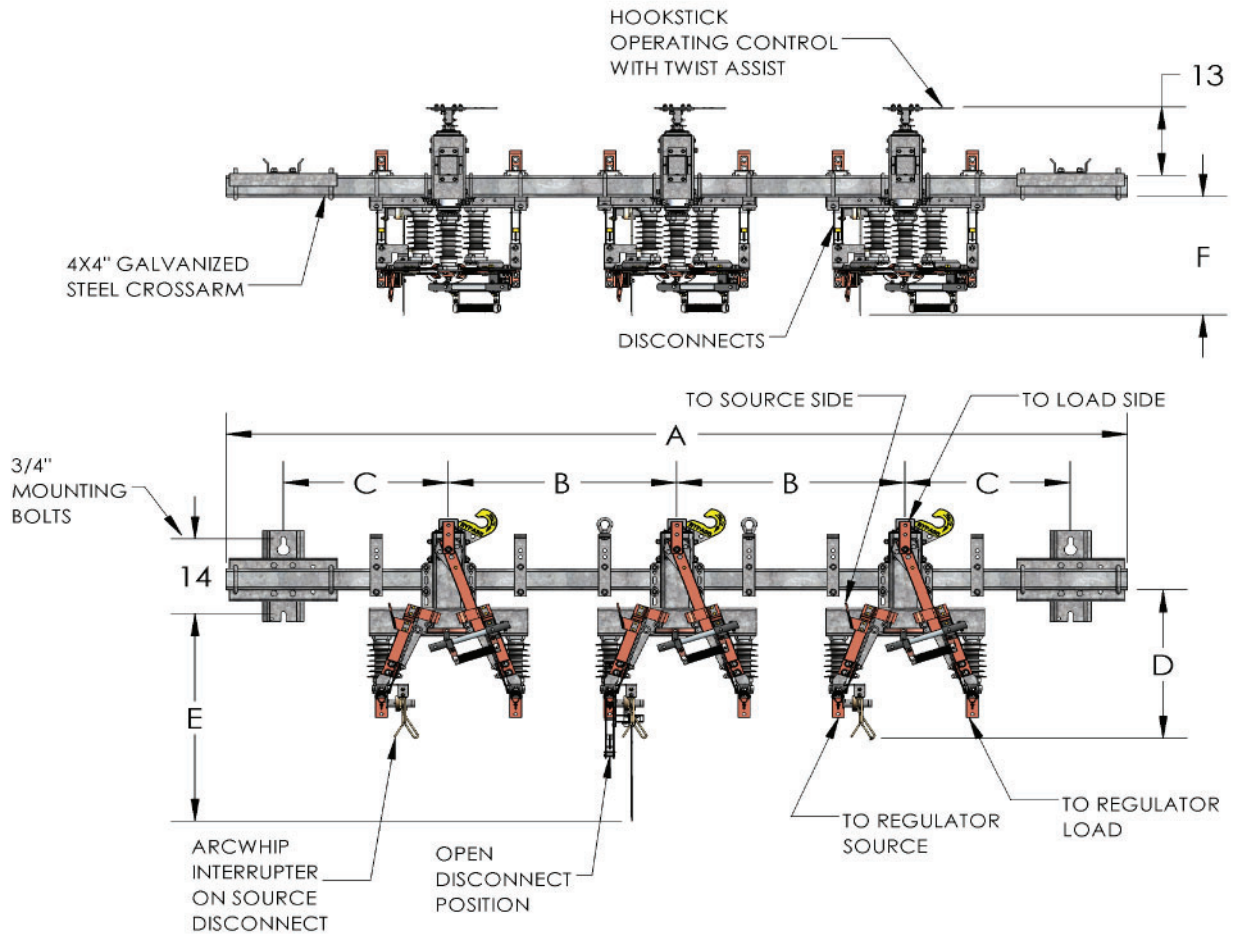
kV	A	B	C	D	E	F
15	180	38	27.5	28	39	22
25	198	44	30.5	32	43	26
38	222	50	36.5	36	47	30

MINIMUM DIMENSIONS

This drawing is for illustrative purposes only and therefore; may, or may not reflect the current revision of this drawing. Please request the current revision from the factory upon quote.

	Materials: N/A	Description: NBS, 15 - 38 kV, Three Pole H-Frame, Reciprocating Dimensions	
	Finish: N/A		
	Scale: NTS		
	Drawn By: N/A	Drawing No.:	Revision:
	Date: N/A	9216-17-2M	


15 - 38 kV NBS Three Pole H-Frame Hookstick Dimensions



kV	A	B	C	D	E	F
15	150	38	27.5	28	39	22
25	168	44	30.5	32	43	26
38	192	50	36.5	36	47	30

MINIMUM DIMENSIONS

This drawing is for illustrative purposes only and therefore; may, or may not reflect the current revision of this drawing. Please request the current revision from the factory upon quote.

	Materials:	N/A	Description: NBS, 15 - 38 kV, Three Pole H-Frame, Reciprocating Dimensions Drawing No.: 9610-25M	Revision: 00
	Finish:	N/A		
	Scale:	NTS		
	Drawn By:	N/A		
	Date:	N/A		



LineBOSS™ GBS

15 kV - 69 kV Sidebreak Type,
FUSED/GROUNDING SWITCH
SPECIALTY SWITCH

The **LineBOSS™** loadbreak grounding switch, **GBS**, is uniquely designed to provide loadbreak, open gap clearances and line grounding for applications in substations or pole line switches. The GBS is available for two arm substation construction with switch bases manufactured to adapt to existing structures, or factory unitized on a single steel crossarm. The GBS is available with fused disconnects for additional system safety requirements. Control mechanisms are built with safety key interlocks to prevent the isolator (loadbreak) switch and the grounding switch from errant closure of both switches.

STANDARD FEATURES

Continuing the **INERTIA LineBOSS™** product line, the GBS is made to ANSI and Inertia standards to provide the most rugged switch available with the following features:

- Solid platform with a 1/4" thick steel base
- All ferrous components are hot dip galvanized
- Insulators are station post insulators either silicone or porcelain with 3" bolt circle
- All components in the current path through the switch are substation grade copper, silver-plated throughout
- Terminal pads are tin-plated for compatibility with all types of commonly used connectors copper, tinned copper, aluminum, bronze etc.)
- Contact clips are reverse loop design for greater contact force during high momentary currents
- Loadbreak options from arc whips, AmpRupter™ expulsion tube interrupter and the AmpVac™ vacuum bottle interrupters.

The GBS shares all of the features of the **LineBOSS™** conventional sidebreak switch. See **LineBOSS™** LBS Features & Benefits for additional information.

SWITCH RATINGS:

Voltage Class: 15 kV, 25 kV, 35 kV, 46 kV & 69 kV
Continuous Current Class: 600 A, 900 A & 1200 A

STANDARD CONFIGURATIONS

- Pole mounted for distribution applications
- Frame mounted for substation applications

