

Type NOVA¹ Single-Phase Recloser and Control Technical Specifications

Introduction

This specification describes the features of the Kyle® Type NOVA¹ Single-Phase Electronically-Controlled Vacuum Recloser. The Type NOVA¹ recloser is a single-phase fault interrupting device suitable for pole mounting, utilizing shatter-resistant outdoor cycloaliphatic epoxy encapsulated axial-field vacuum interrupters.

This specification also describes the features of the electronic control which provides the necessary requirements to supervise and operate the attached NOVA¹ single-phase recloser. The NOVA¹ control is a self-powered single-phase overcurrent electronic recloser control. Control sensing is supplied by line current flowing through the recloser via the sensing C.T. (current transformer). Control parameters are programmed by setting dip switches on the circuit board. Time current curves are determined by two field changeable plug-in circuit boards. Remote monitoring and control are provided through the SCADA accessory option. Mechanism power is supplied by a 59-V battery pack.

Standards

The Type NOVA¹ recloser and control have been designed and tested in accordance with the following standards as applicable:

C37.60-1981 American National Standard Requirements for Overhead Pad-Mounted, Dry Vault and Submersible Automatic Circuit Reclosers and Fault Interrupters for Alternating Current Systems.

C37.61-1973/Std. 321-1973 (IEEE). IEEE Standard Guide for the Application, Operation and Maintenance of Automatic Circuit Reclosers.

C37.85 -1989 American National Standard Safety Requirements for X-Radiation Limits for AC High-Voltage Power Switchgear.

C37.90 -1978 (ANSI/IEEE) American National Standard Guide for Surge Withstand Capability (SWC) tests.

Kyle Spec 574 Surge Withstand and Capability Testing of Electronic Controls.

Weight	NOVA ¹ -15	NOVA ¹ -27
Recloser - kg (lbs)	48 (105)	50 (110)
Control - kg (lbs)	16 (35)	16 (35)

Voltage Ratings

Maximum Design Voltage (kV)	
NOVA ¹ -15	15.5
NOVA ¹ -27	29.2
Nominal Operating Voltage (kV)	
NOVA ¹ -15	14.4
NOVA ¹ -27	24.9
Basic Insulation Level (kV)	
NOVA ¹ -15	110
NOVA ¹ -27	125
60 Hertz Withstand Voltage	
Dry, one minute	
NOVA ¹ -15	50
NOVA ¹ -27	60
Wet, ten seconds	
NOVA ¹ -15	45
NOVA ¹ -27	50
Radio Influence Voltage (RIV)	
100 μV Maximum (kV)	
NOVA ¹ -15	9.4
NOVA ¹ -27	16.4

Current Ratings

Continuous Current Ratings (Amps)	
NOVA ¹ -15, NOVA ¹ -27	400/800
Symmetric Interrupting Current (Amps)	
NOVA ¹ -15, NOVA ¹ 27 (400 Amp)	8,000
NOVA ¹ -15, NOVA ¹ 27 (800 Amp)	12,500
Overload Capability	
NOVA ¹ -15, NOVA ¹ -27	
400 Amp	
125% - 4 hours (Amps)	500
150% - 2 hours (Amps)	600
800 Amp	
No overload rating	
Cable Charging Current	
NOVA ¹ -15 (Amps)	10
NOVA ¹ -27 (Amps)	25
Magnetizing Current	
400 Amps	14
800 Amps	28
Three-Second Current Symmetric (Amps)	
NOVA ¹ -15, NOVA ¹ 27 (400 Amp)	8,000
NOVA ¹ -15, NOVA ¹ 27 (800 Amp)	12,500

Mechanical Life

Minimum Operations 2,500

Frequency

Rated Frequency (Hz) 50/60

Duty Cycle

Percent of Maximum Circuit Interrupting Rating	Minimum X/R Ratio	Number of Unit Operations
15-20	4	88
45-55	8	112
90-100	15	32
		Total 232

Creepage

Distances NOVA¹-15 NOVA¹-27

Terminal to	719 mm	719 mm
Terminal	28.25 in	28.25 in
Lower Terminal	630 mm	798 mm
to Ground	24.75 in	31.5 in

Recloser Features

The manufacturer shall have no less than 10 years experience in the design and fabrication of reclosers.

The recloser shall be able to operate at 800 Amps continuous up to 12.5 kA interrupting at 15.5 kV or 29.2 kV.

The recloser shall be mechanically and electrically trip free. Any applied close signal, either mechanically or electrically, will not inhibit the recloser from tripping on the programmed time-current curve.

Environmentally-friendly cycloaliphatic epoxy shall be used as the dielectric medium. SF6 gas shall not be acceptable as an insulating medium.

There shall be no porcelain on the external portion of the recloser.

A sensing bushing current transformer, 1000:1 ratio, for use with the recloser control, shall be an integral part of the recloser.

A 4-digit mechanical counter shall be provided under the sleethood.

A manual operating handle shall be provided under the sleethood.

Pulling the yellow handle down when in the closed position will result in a manual opening operation. With the handle in the "down" position, the recloser is in a "lock-out" position and will not accept an electrical close signal from the control.

When the yellow handle is raised, the control will give an electrical close signal which will close the recloser. The recloser cannot be closed manually without connection to a properly operating electronic control since all closing operations are electrical closings.

A red/green (closed/open) indicator flag shall be visible on the side of the sleethood to provide contact position indication.

A hookstick-operable non-reclosing handle shall be provided under the sleethood. With the non-reclosing handle in the down position, only one trip operation to lock-out will occur.

Close and trip capacitors shall be used to store the necessary energy for operating the recloser. Only the close capacitor energy shall be used for closing while both capacitors are available for opening; therefore, trip energy shall be available following any electrical close.

The recloser shall be self-powered, negating the need for customer-supplied auxilliary power sources and their associated protection and connection schemes. Batteries are the desired method with an approximate service life exceeding five years.

The recloser operation shall be controlled by an electronic control that can be located remotely, up to 80 feet from the recloser. The control shall be housed in a weatherproof steel cabinet with a side-hinged lockable door.

The control response to overcurrents shall be within $\pm 10\%$ of time or current, or $\pm .010$ seconds, whichever tolerance is greater for any time-current characteristic programmed. The accuracy is based on 25°C ambient. The operating temperature range for the control shall be -40°C to +65°C, ambient.

Control power shall be supplied by the integral current transformer when a minimum of five Amperes is flowing through the recloser.

A nominal 59-Volt, 8.5 Amp-hour, lithium battery shall provide the energy required to operate the recloser mechanism. The mechanism battery shall be housed in the control cabinet with the proper high power connections. The mechanism battery shall contain internal fusing to protect both the control and itself from short-circuit and overtemperature conditions. The mechanism battery shall be designed to last six years under normal use.

The control shall include a 9-Volt, 1.2 Amp-hour lithium control back-up battery to supply power when line current drops below five Amperes. The control shall be able to trip the recloser without the control battery. The control back-up battery shall be designed to last six years under normal use. Battery life shall be independent of number of trip operations.

Both the 9-Volt control battery and the 59-Volt mechanism battery shall be required to close the recloser via SCADA or the yellow handle. The control battery shall not be required to trip the recloser via overcurrent. The mechanism battery shall retain the ability to trip the

recloser via overcurrent, if disconnected for less than ten minutes.

Control parameters shall be programmed by setting dip switches on the circuit board. These parameters include minimum trip, operations to lockout, operations on TCC #1, minimum response time enable, minimum response time settings, TCC modifiers, reclose time, reset time, and cold load pick-up time delay.

Time current curves shall be determined by two field changeable plug-in circuit boards.

Remote monitoring may be provided through an Input/Output board, including remote lockout, remote close, remote non-reclose, remote contact position indicator, remote lockout indicator, remote non-reclose status, and remote analog current monitoring.

The control shall have a sequence coordination feature which allows the NOVA¹ to step through its "fast" curve without tripping to provide complete trip coordination with a downline recloser.

The control lockout shall have a target provided on the bottom of the control cabinet that shows orange during control lockout.

Control/Recloser Interaction

Local recloser open and close operations shall be performed by lowering and raising the yellow handle on the recloser.

A second handle on the recloser shall be lowered to put the control in non-reclose mode. If the recloser is open when the non-reclose handle is down, the control shall go to lockout mode, and the lockout indicator on the bottom of the control shall toggle to the lockout position (orange flag showing).

When a control is connected to a closed recloser, the control shall reset to the zero sequence position in the time determined by the reset dip switch setting.

Control Lockout

Control lockout shall be indicated on the bottom of the control cabinet. When the control is in lockout, the display shall be orange and the control will not issue a close signal. When the control is not in lockout, the display shall be black.

Lockout mode shall be cleared and the indicator shall reset after the recloser is closed manually or via a remote close signal from SCADA, and the preset cold load pickup time has elapsed.

Time-Current Curve Selection

Time-current curves shall be determined by two field-changeable plug-in circuit boards labeled TCC1 and TCC2 on the main circuit board. Normally, the TCC1 position shall be used for the fast curves and TCC2 shall be used for the delayed curves.

Any combination of the two TCC's can be programmed up to a four-event sequence by programming the number of operations-to-lockout and the number of operations on TCC1. All operations on TCC1, if any, shall be performed first.

All TCC's shall be accurate to 30 times minimum trip.

Minimum Trip

The minimum trip value shall be selectable from 10 to 1270 Amperes in 10 Ampere increments. Minimum response shall not exceed $\pm 5\%$ of the response at 25°C (ambient) over the design temperature range of -40°C to +65°C. The mechanism is rated to 55°C.

Operations to Lockout

The number of operations to lockout shall be selectable from 1 to 4. If no operations are selected, the control shall default to 4. Lowering the non-reclose handle on the recloser shall override this setting.

Operations on TCC#1

The number of operations on TCC#1 shall be selectable from 0 to 4. If no operations are selected, the control shall default to zero. Operations to lockout shall determine the total number of operations. The number of operations on TCC#2, if any, shall be equal to the number of operations to lockout minus the number of operations on TCC#1 (negative remainder shall mean zero).

Minimum Response Time

Each TCC can be modified from its base curve by the Minimum Response Time function and the TCC Modifier.

The time-current characteristic of any of the four possible operations can be modified by enabling the minimum response time function for that operation. Minimum response time shall prevent the control from issuing a trip signal until the programmed time from the beginning of the overcurrent has elapsed.

Two dip switches shall be used to select the minimum response time function. The first dip switch selects which operations will be modified. Any combination of the four possible events shall be valid.

The second dip switch shall select the time value. The range shall be from 10 to 1280 milliseconds in 10 millisecond increments.

TCC Modifier

This function shall shift the curve vertically. Four different shapes shall exist for each TCC plug: Mod0 (unmodified), Mod1, Mod2, and Mod3. In general, as the modification level increases, the TCC shall become faster and less inverse.

TCC1 and TCC2 shall be modifiable independent of each other.

Reclose Time

Reclose time shall be dip switch selectable from 1 to 64 seconds in one second intervals.

Reset Time

Reset time shall be dip switch selectable from 1 to 127 seconds in two second intervals. The recloser shall be in the closed position without an overcurrent present for the selected amount of time before the control will reset the operations counter and the TCC selector.

Cold Load Pickup

Cold load pickup time shall be dip switch selectable from 0 to 127.5 seconds in .5 second intervals. Cold load pickup shall be active after closing the recloser from lockout condition for the time selected. During this time, the control shall be in one operation to lockout mode and overcurrent timing shall be on TCC2. If no overcurrent is present during this period, the control will reset.

Sequence Coordination

The control shall have a sequence coordination feature which allows the NOVA¹ to step through its "fast" curve without tripping to provide complete trip coordination with a downline recloser.

Remote Features (SCADA Accessory)

All remote features shall be accessed through a 19 pin connector (type MS3106 size 22-14 female) mounted on the bottom of the control. Functions available remotely shall include:

- Remote Trip and Lockout
- Remote Close with Cold Load Pickup
- Remote Non-Reclose Control
- Remote Recloser Open/Closed Status
- Remote Lockout Status
- Remote Non-Reclose Status
- Remote Analog Current Monitor

