ABB Power T&D Company Inc.
Relay Division
Coral Springs, FL
Allentown, PA

September, 1990
Supersedes Descriptive Bulletin 41-350,
pages 1-2, dated September, 1989
Mailed to: E, D, C/41-100A

Device Number: 50

HRU Instantaneous Overcurrent Relay with Harmonic Restraint

Application
The HRU harmonic restraint relay is a high speed relay used for the supervision of differential, overcurrent, or pilot relays. It is applied in various transformer protection schemes to provide security against false tripping on transformer magnetization inrush.

Operation
Magnetizing inrush currents have various wave shapes. A typical current appears as a rectified half wave with decaying peaks. The various wave shapes are rich in harmonics with the second harmonic predominant. Since the second harmonic is always present in inrush waves and not internal fault waves, this harmonic is used to restrain the harmonic-restraint unit during inrush. The differential, overcurrent or pilot relay may or may not close its contact, depending on the magnitude of the inrush. If the HRU contact is supervising these contacts, the scheme will **not** trip on magnetizing inrush.

When a magnetizing inrush current is applied to the relay, the dc component of the wave is by-passed by the air-gap operating transformer. The other components are fed into the filter circuits. The impedance characteristics of these filters are such that the second harmonic component flows into the restraint coil of the polar unit, while the fundamental and other harmonics flow into the operating coil. The polar unit will not close its contacts unless the second harmonic content is less than 15 percent of the fundamental component.

Fault currents will normally appear as an offset sine wave with a decaying dc component and contain very few harmonics. As a result then the harmonic restraint unit and instantaneous trip will operate during faults to permit tripping of the relay.

The varistor connected across the dc side of the restraint rectifier of the harmonic restraint unit prevents excessive voltage peaks from appearing across the rectifiers. These peaks arise through transformer action of the harmonic-restraint polar-unit coils during heavy faults. The varistor has a large value of resistance for low voltages while presenting a low value of resistance for high voltages. This characteristic effectively reduces the voltage spikes on heavy faults while not hampering performance during inrush, where the voltage is considerably lower.

Construction
The single phase HRU relay consists of an instantaneous trip unit, a harmonic restraint unit, and an indicating contactor switch.

The three-phase HRU relay consists of the same parts as the single-phase, except with a mixing transformer included. (See internal schematics).

① **Harmonic Restraint Unit** – consists of an air-gap transformer, a second harmonic block filter, a fundamental block-second harmonic pass filter, two full wave rectifiers, a varistor, and a polar unit.

② **Instantaneous Trip Unit** – is a small ac operated clapper type device. Adjustment of the pickup is accomplished by changing the setting of an adjustable core screw. A range of adjustment of 4:1 may be made.

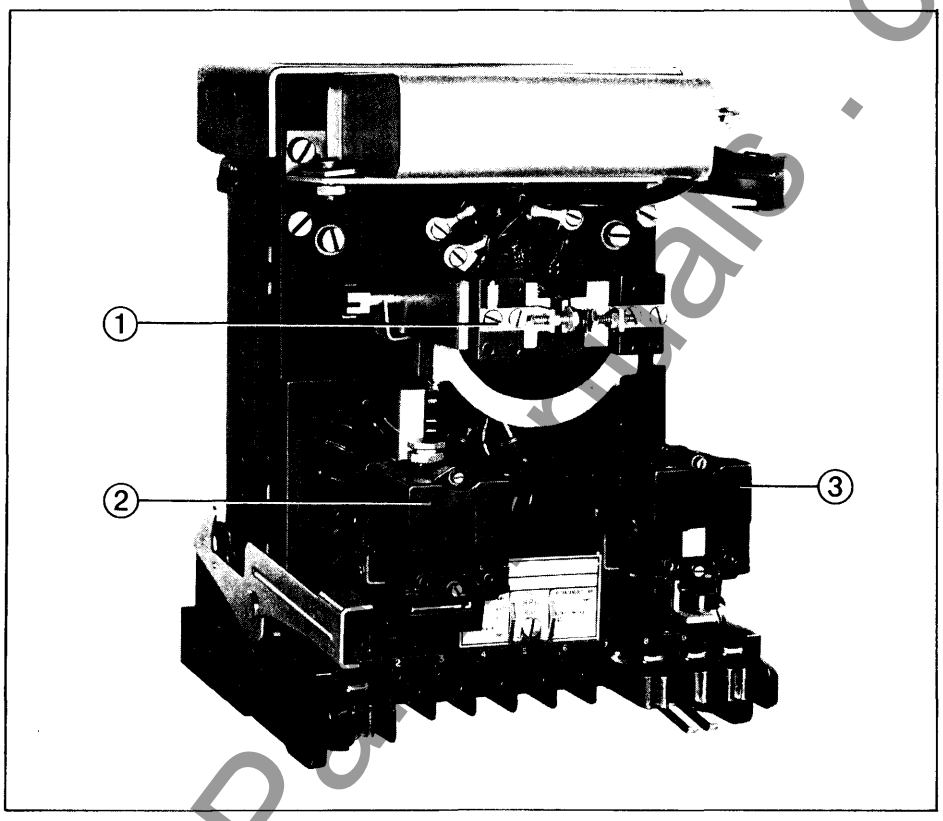
③ **Indicating Contactor Switch** – is a small dc operated clapper type device. No settings are required except the selection of the 0.2 or 2.0 ampere tap. When the relay is to energize a 125 or 250 Vdc type WL relay switch or equivalent, use the 0.2 amp tap; for 48 Vdc applications set relay in the 2.0 amp tap and use WL relay coil style number 304C209G01 or equivalent.

Characteristics

Rated Current	Continuous Rating	1 Second	Burden@	
			Tap Value	8 Times
.87	10 amp	300 amp	2.26	76
2.00	18 amp	300 amp	2.50	92
4.00	22 amp	300 amp	3.18	132

Continuous rating of 3-phase HRU – 5.75 amp.
Frequency Response: Curve 471052

Further Information
List Prices: PL 41-020
Technical Data: TD 41-025
Instructions: IL 41-347.3
Renewal Parts: RPD 41-937
Flexitest Case Dimensions: DB 41-076
Contactor Switches: DB 41-081
Other Protective Relays:
Application Selector Guide, TD 41-016



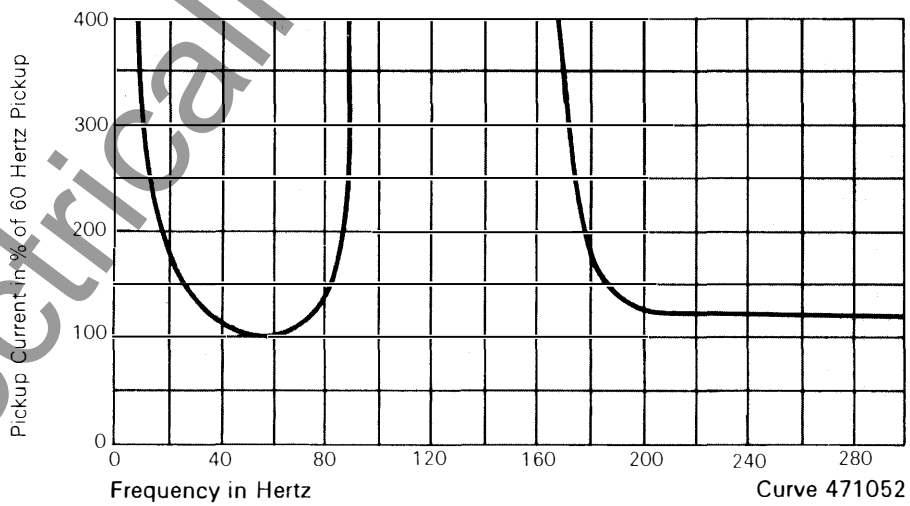


Figure 1

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ABB Power T&D Company Inc.
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December, 1990
Supersedes TD 41-020, Type HRU on page 67, dated November, 1987
Mailed to: E, D, C/41-100A

HRU Instantaneous Overcurrent Relay with Harmonic Restraint

Instantaneous Overcurrent, Second Harmonic Restraint (Device Number: 50)

Type	Contacts	Applications Harmonic Restraint Supervision	Indicating Contact Switch	Sensitivity	IIT	Relay Data		
						Internal Schematic	Style Number	Case Size
HRU	Spst-cc	3-phase	0.2/2.0 Amp dc	.87 amps	(3 units) 20-80 amps	837A104	670B109A09	**FT-31**
	Spst-cc				(1 unit)			
		1-phase		.87 amps	1-4 amps	187A512⑦	292B024A11	**FT-21**
				.87 amps	1-4 amps	861A783⑧	292B024A16	
				.87 amps	20-80 amps	861A783⑧	292B024A12	
				2.0 amps	1-4 amps	187A512⑦	292B024A10	
				4.0 amps	4-16 amps	187A512⑦	292B024A09	

⑦ HRU and IIT contacts are in series.
⑧ HRU and IIT contacts are in parallel.