



# SHERMAN & REILLY

400 West 33rd St. • Chattanooga, TN 37410-1267 USA

Toll Free 1.800.251.7780 • Phone 423.756.5300 • Fax 423.756.2948

Web Site - <http://www.sherman-reilly.com> • E-Mail - [sales@sherman-reilly.com](mailto:sales@sherman-reilly.com)

**Conductivity  
Tests  
Data**

## Conductivity Tests Data

### Sherman & Reilly Blocks with Conductive Type Neoprene Lining

Effective grounding of stringing blocks is extremely important in areas where induced, static, or impulse voltages might be encountered during construction. Establishment of typical values of the conductivity of the entire block including the neoprene lining were needed. Having a value expressing the conductivity of neoprene per cubic centimeter as it is usually measured is meaningless in this application.

The conductors having stranded outer layers and being somewhat smaller than the groove profile makes it virtually impossible to determine the area of contact. This will vary with the tension in the wire, the break-over angle, the vertical load on the block, groove size, and the wire size. Total resistance must include the path from the groove where the wire is riding, through the bearings, and to the frame where a lead can be taken to ground.

Neoprene is made conductive by using a special conductive carbon black for reinforcement instead of the usual carbon black, which is used as reinforcement of the non-conductive neoprene.

Neoprene, like all rubbers, is an organic compound and, consequently, is combustible. Any considerable wattage of current flowing through the small area of contact between the wire and the neoprene will raise the temperature to the point of combustion or structure breakdown. If this occurs, there is a warning because the conductivity sharply increases immediately and the odor and smoke are apparent.

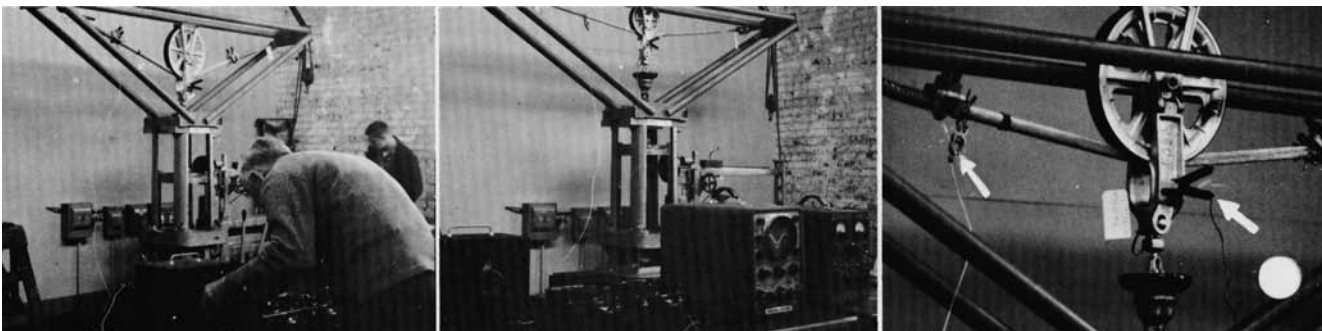
Realizing the importance of establishing values for Sherman & Reilly blocks with neoprene lining,

conductive type, we employed the services of Dr. F. O. Nottingham, a Professor of Electrical Engineering, Georgia Institute of Technology. Pictured below is the mechanical setup and the instrumentation, which is explained in the circuit diagram on page 8-6. A range of block sizes from 7" through 35" with conductors of 336,400 CM to 2,157,400 CM were tested with varying breakover angles and tensions.

The data tabulated from the extensive test program illustrate the very low voltages at which substantial currents flow through these conductive neoprene linings without damage to the lining. This emphasizes the effective drainage of induced currents at voltages well below any hazard level, provided the blocks are connected to grounds having equally low resistance. The resistance of the ground to which the blocks are connected is of vital importance. Inadequate grounding will probably result in burning the neoprene lining if any substantial induced current and potential occur.

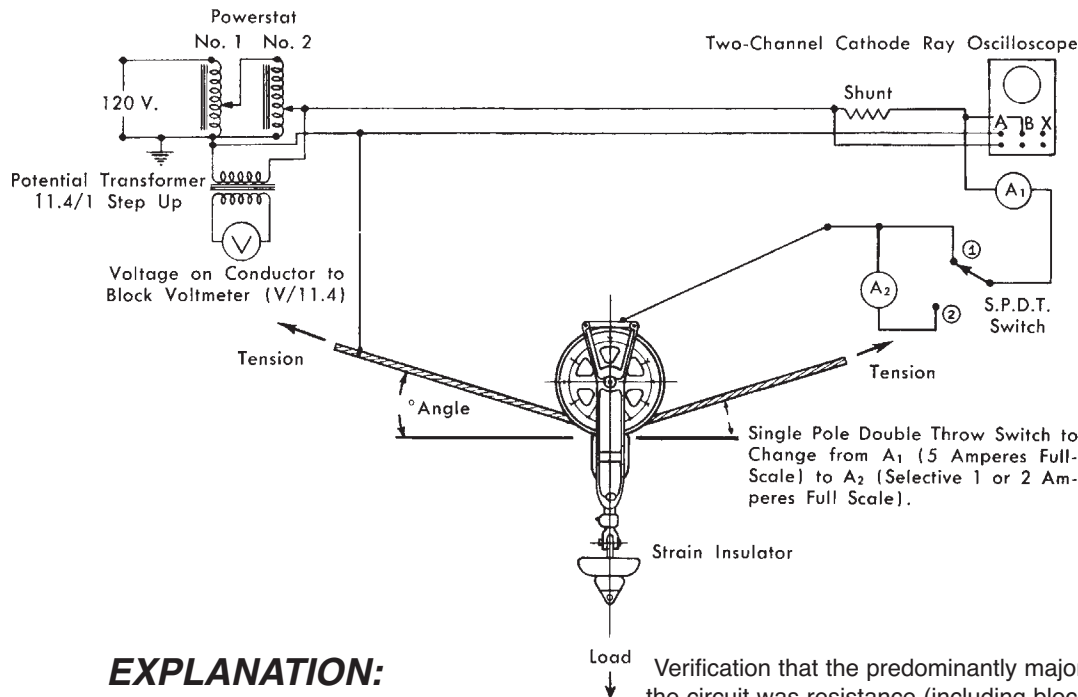
These values conclusively prove that Sherman and Reilly's conductive neoprene lining in S&R blocks has such low resistance at very low voltages that any hazardous amount of current would be readily drained from the line if the blocks are connected to a low resistance ground. This is possible because of a very homogeneous compound which is molded in the sheave under closely controlled manufacturing procedure.

We feel these tests have resulted in very valuable conclusions that should be considered during the planning stages of all line construction projects.





**Conductivity Tests Data**



**EXPLANATION:**

1. For currents above 2 amps. the S.P.D.T. switch was on Position I. The resistance of instruments leads and shunt are listed below.

Weston Ammeter (A <sub>1</sub> )	0.026 ohm
Leads and shunt	0.081 ohm
Total	0.107 ohm = R <sub>a</sub>

2. For currents above 1.0 amps. and less than 2.0 amps. S.P.D.T. switch on Position 2 and GE Ammeter (A<sub>2</sub>) on 2.0 amps. scale.

Weston Ammeter (A <sub>1</sub> )	0.026 ohm
GE Ammeter (A <sub>2</sub> )	0.327 ohm
Leads and shunt	0.081 ohm
Total	0.434 ohm = R <sub>a</sub>

3. For currents of 1.0 amps. or less, S.P.D.T. switch on Position 2 and GE Ammeter (A<sub>2</sub>) on 1.0 amps. scale.

Weston Ammeter (A <sub>1</sub> )	0.026 ohm
GE Ammeter (A <sub>2</sub> )	1.065 ohm
Leads and shunt	0.081 ohm
Total	1.172 ohm = R <sub>a</sub>

The above values are based on Wheatstone Bridge measurements of the resistance values presented here.

Voltage across samples was low so that it was necessary to step up the applied voltage so it could be read on the GE Voltmeter (V) used. The potential transformer used had a step-up ratio of 11.4:1 = M.

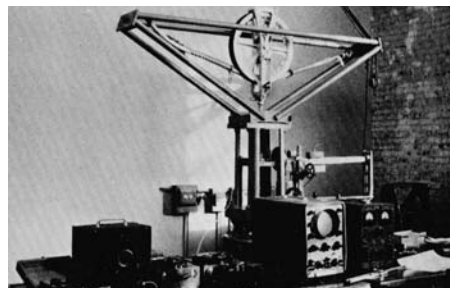
The voltage applied to the samples was less than the applied voltage by the Ammeter and leads drops.

Verification that the predominantly major component of the circuit was resistance (including block being tested) was furnished by the cathode-ray oscillograph. The larger wave was that of voltage across test block and the smaller wave was the current through the test block. Verification was furnished by the in-phase condition shown on screen of cathode ray oscillograph (C. R. O.).

Two powerstats in cascade were used in order to achieve finer control of current to block under test.

**EXAMPLE OF CALCULATIONS:**

Test No. 1-F  
 Block Size, Inches – 35  
 Line Tension, Pounds – 10,000  
 Breakover Angle – 9°  
 Conductor Size – 2,157,400 C. M.  
 I (Amperage) – 5 Amps.  
 R<sub>a</sub> (Resistance) – 0.107 ohms  
 Gross Voltage = V/M = 166/11.4 = 14.56  
 Test Voltage = (V/M) - IR<sub>a</sub>  
 IR<sub>a</sub> = 5 x 0.107 = 0.535  
 V<sub>b</sub> (Test Voltage) = 14.56 - 0.535 = 14.025 Volts  
 R<sub>b</sub> (Resistance) = V<sub>b</sub>/I = 14.025/5 = 2.805 ohms





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## Engineering Data

## Engineering Data

The following table gives typical results on seven different block sizes and six wire sizes at varying tensions and breakover angles. These were selected from 304 individual tests and represent the maximum wattages in each group of tests.

Test	Block Size, Inches	Line Tension, Pounds	Load on Block, Pounds	Break-over* Angle, Degrees	Conductor Size				I** Amperage	V <sub>b</sub> ** Voltage	R <sub>b</sub> ** Ohms
					Cir. Mills	Stranding		O.D.			
						Aluminum	Steel				
1-A	35	6,000	3,600	35	2,157,400	61	—	1.65	5.00	7.535	1.507
1-B	35	8,000	4,800	35	2,157,400	61	—	1.65	5.00	6.904	1.381
1-C	35	10,000	6,000	35	2,157,400	61	—	1.65	5.00	6.351	1.270
1-D	35	6,000	,940	9	2,157,400	61	—	1.65	5.00	14.912	3.030
1-E	35	8,000	1,260	9	2,157,400	61	—	1.65	5.00	14.728	2.946
4-A	28	6,000	3,600	35	1,780,000	84	19	1.602	5.00	11.307	2.261
4-B	28	8,000	4,800	35	1,780,000	84	19	1.602	5.00	11.131	2.261
4-C	28	10,000	6,000	35	1,780,000	84	19	1.602	4.93	10.437	2.117
4-D	28	6,000	2,290	22	1,780,000	84	19	1.602	5.00	16.044	3.209
4-E	28	10,000	3,820	22	1,780,000	84	19	1.602	5.00	13.973	2.794
4-F	28	6,000	,940	9	1,780,000	84	19	1.602	5.00	18.236	3.647
4-G	28	10,000	1,570	9	1,780,000	84	19	1.602	5.00	16.921	3.384
6-A	20	6,000	3,600	35	1,431,000	45	7	1.427	5.00	26.483	5.297
6-B	20	10,000	6,000	35	1,431,000	45	7	1.427	5.00	22.973	4.595
6-C	20	6,000	2,290	22	1,431,000	45	7	1.427	5.00	38.236	7.647
6-D	20	10,000	3,820	22	1,431,000	45	7	1.427	5.00	31.570	6.314
6-E	20	6,000	,940	9	1,431,000	45	7	1.427	5.00	43.763	8.572
6-F	20	10,000	1,570	9	1,431,000	45	7	1.427	5.00	37.622	7.524
5-A	16	5,000	3,000	35	1,272,000	45	7	1.345	5.00	25.342	5.068
5-B	16	9,000	5,400	35	1,272,000	45	7	1.345	5.00	22.535	4.507
5-C	16	5,000	1,905	22	1,272,000	45	7	1.345	5.00	29.728	5.946
5-D	16	9,000	3,430	22	1,272,000	45	7	1.345	5.00	25.342	5.068
5-E	16	5,000	,785	9	1,272,000	45	7	1.345	4.00	27.993	6.998
5-F	16	9,000	1,415	35	1,272,000	45	7	1.345	4.00	26.150	6.538
8-A	12	3,000	1,800	35	795,000	26	7	1.108	2.50	26.486	10.594
8-B	12	7,000	4,200	35	795,000	26	7	1.108	2.00	25.974	12.987
8-C	12	3,000	1,140	22	795,000	26	7	1.108	2.00	25.447	12.723
8-D	12	7,000	2,770	22	795,000	26	7	1.108	2.00	26.763	13.381
8-E	12	3,000	,470	9	795,000	26	7	1.108	1.00	28.213	28.213
7-A	10	1,000	,600	35	336,400	26	7	.721	5.00	28.412	5.682
7-B	10	3,000	1,800	35	336,400	26	7	.721	4.00	24.308	6.077
7-C	10	1,000	,380	22	336,400	26	7	.721	3.00	29.064	9.688
7-D	10	3,000	1,140	22	336,400	26	7	.721	3.00	23.539	7.846
7-E	10	1,000	,160	9	336,400	26	7	.721	2.50	29.995	11.998
7-F	10	3,000	,470	9	336,400	26	7	.721	2.50	24.732	9.893
2-A	7	1,000	,600	35	336,400	26	7	.721	5.00	30.780	6.156
2-B	7	2,000	1,200	35	336,400	26	7	.721	5.00	25.780	5.156
2-C	7	3,000	1,800	35	336,400	26	7	.721	5.00	24.728	4.946
2-D	7	1,000	,100	9	336,400	26	7	.721	2.00	26.061	13.030
2-E	7	2,000	,314	9	336,400	26	7	.721	2.00	23.868	11.934
2-F	7	3,000	,470	9	336,400	26	7	.721	2.00	23.781	11.891

\*Breakover angle is the sum of the angles on both sides of block taken from horizontal to angle of wire.

\*\*See example of calculation on opposite page.



## Conclusions of Conductivity Tests

### Observations and Conclusions:

1. In the majority of tests, the block resistance ( $R_b$ ) shows a rising trend as the current is reduced. This indicates a dependence of resistance on current and is a characteristic of carbon resistors. This property tends to limit the drop across a block due to passage of current through the conducting neoprene lining.
2. Greater breakover angles result in reduced block resistances.
3. In every case, the drop across the test blocks is decidedly less than necessary to produce a shock if the block is properly grounded when conductors are being strung.
4. This range of tests shows the effectiveness of S&R stringing blocks with conductive type neoprene linings in conducting induced charges to ground when properly grounded.

*Dr. F. O. Nottingham, Jr.*

### ABRASION TESTS

Neoprene lining was first developed when it became necessary to use wire rope pulling lines after the innovation of tension stringing. Since its usefulness in this application proved so successful, many distribution type blocks are now being used with neoprene lining. The purpose on distribution blocks is to enable using the same ones for aluminum conductors, copper conductors, and steel overhead ground wires. The neoprene lining is also an excellent protection for the groove in everyday handling that

often mars the polished aluminum groove. Consequently, the life of the blocks is substantially increased.

The resilience of Type GNA Neoprene in a 70 to 80 durometer range is effective in better conductivity as pointed out in the preceding pages. This resilience also offers additional support to the conductor, and this added support is particularly important in tension stringing on long pulls and heavy breakovers.

On the testing machine pictured below, the abrasion resistance of the Sherman & Reilly vulcanized-in-place and permanently bonded neoprene is checked. This machine is designed to simulate typical loads encountered in the field with average breakover angles. The line speed is 300 ft. per minute or about 3 miles per hour. Tests are conducted usually with 5/8" wire rope under approximately 4,000 pounds tension and are run for a 1,000 mile duration. The average wear after this severe test is typically about 1/32". As a minimum thickness in the bottom of the groove of all Sherman & Reilly sheaves is 3/16", the actual life under normal operating conditions should be several times the 1,000 mile test.

For added protection and to ensure a perfect bond, our FULL neoprene lining comes over the edge of the sheave rim. In passing swivels, compression joints, and running boards in cases of bundle blocks, this is very important.

Sherman & Reilly neoprene linings are continually being tested for abrasion resistance, conductivity, and durometer hardness. This ensures a product that will perform under almost all conditions normally encountered during line construction.

