

CHECKING LOAD ON
INDIVIDUAL LEADS

1. GENERAL

1.01 This section covers various methods of checking the actual current being carried by individual circuits without interrupting service. It is for use during periodic measurements to check and correct power drain tables in connection with additions, to see if the proposed additional load can be accommodated without increasing conductor or apparatus size, and where it is suspected that peak currents might exceed the value for which the circuit is designed. Where overload or approaching overload is discovered, it should be reported so that a redistribution of the load or additional lead and apparatus capacity may be considered by the Engineering Department.

1.02 This section is reissued to refer to loads in leads rather than on fuses, to add apparatus, and to expand instructions.

1.03 The procedures suggested herein should be made only on approval of the supervisor.

1.04 In general, fuses in distribution circuits are not operated at near their maximum value. Where, however, a fuse several years old is found to be carrying near its rated load, it is suggested that a new fuse be installed if this is feasible without interrupting service. Fuses deteriorate with time and use at higher temperatures, so that an old fuse may sometimes blow at slightly less than its rated value.

1.05 This section is not required when determining loads in leads equipped permanently with an ammeter. In such a case, the current at any time can be read on the ammeter, or a load recorder can be applied in accordance with Section 171-122-301.

1.06 Ammeters with internal shunts, as well as 901 instruments with 150-ampere shunts, are read direct. On 901-ammeter, readings are divided by 5 when using 30-ampere shunts and are multiplied by 10 when using 1500 ampere shunts. Where available, the older 45-type ammeters and associated shunts are satisfactory.

Caution: Be sure that any temporary connections are reliable to avoid short circuits or the opening of working circuits.

2. APPARATUS

Ammeter, ac, Weston No. 528. (Range as required. 1, 3, 5, 10, and 50 amp available. Use 1 amp range and current transformer for larger currents).

Ammeter, ac-dc, with carrying case, Clamp-on, Columbia Elect. Mfg. Co. Specify type and ranges.

Type P 20-range.

Type CS 75, 200, and 500 ranges. (dc calibration, if desired).

Ammeter, dc, Weston No. 280, 30-3-1.5 ranges or 100 range as required.

Ammeter, dc, Weston No. 901, 150 scale divisions. (For use with 50-millivolt shunt.)

Resistor, Ward-Leonard 24-ohm Ribflex, 224-type terminals in Steps of 2.1, 2.1, 4.8, and 15 ohms, assembled in type 820 mounting.

Shunt, ammeter, KS-9442, List 21, 30 amps, List 6, 150 amps or List 14, 1500 amps (For use with 901 ammeter.)

Switch (of sufficient rating to carry the 5 to 10 per cent supplementary load. See Part 5).

Transformer, current, Weston No. 539 (For use with 528 ammeter.)

Volt-ohm-milliammeter, KS-14510 (use as a voltmeter).

3. USE OF CLAMP ON AMMETER (AC OR DC)

3.01 Of the listed clamp on ammeters, the P is satisfactory down to 5 amperes on leads up to 1-1/2 inch diameter and the C down to 20 amperes on conductors up to 2-9/16 inch. The CS is now recommended instead of the previously listed AX because it is more convenient for use around fuses and can be applied to larger conductors. The AX was satisfactory down to 20 amperes on leads up to 1-9/16 inch. Where it is available and adequate, there is no objection to its use. The listed instruments can be used on either dc or ac. The P has an advertized accuracy of 2 per cent on either ac or dc. The CS, like the AX, has an advertized accuracy of 5 per cent on dc and 2 per cent on ac, but better accuracy can be had on dc by specifying dc calibration.

in the order. Additional reliability of readings on dc can be obtained by using the average of readings taken with the jaws reversed and by setting the pointer on zero with the zero adjuster at no load, and then comparing the load readings at various points on the scale with readings of a standard instrument to determine necessary correction at such points. For special applications Columbia makes other clamps on ammeters with ranges up to 1000 amperes. On ranges larger than 500 amperes, however, the same scale unit cannot be used on both ac and dc.

3.02 Select the element required, avoiding readings in the restricted area at bottom of the scale. To remove element, use both hands, pulling back spring clips with the thumbs while exerting upward pressure with the fingers until element is lifted from its seat and can be withdrawn without forcing. Do not use screwdriver or other tool to exert leverage. To insert element, slide it into place with care and see that spring clips hold the element firmly in place. Scale elements furnished with one clamp on instrument cannot be used with another without factory recalibration.

3.03 Select the point at which readings are to be made. Where there is a fuse and switch unit, the best place to take the readings may well be around the shorting switch blade after removing the shorted fuse. Be sure the fuse is shorted before removing it and replace it immediately after the reading. In many cases the most convenient location for readings is around the fuse. This is usually true only where a type CS instrument is available and there is ample space between fuses and around the fuse. In many cases, it may be necessary to clamp around a bus bar or lead. Occasionally it may be necessary to cut the sewing cord to get the lead out of a local form for the readings. In such a case, resew the form after the reading. Jaws are insulated for use on either bare or insulated conductors up to 440 volts.

3.04 Before clamping the jaws around the conductor open the jaws by squeezing the trigger and allow the jaws to snap shut. This is to assure uniform magnetic circuit for readings. See that faces of the jaws are clean.

3.05 For dc checks, measure current in both directions by reversing the jaws and use the mean. When using type CS instrument, be sure the conductor is within the red or white marks on the jaws. Fields from apparatus, such as transformers, larger inductors, or large contactors, may affect readings if within a few inches of the ammeter. This is also true of leads near the ammeter if carrying high currents, say 100 amperes or more. Where such fields are

suspected, try the readings with the ammeter in different positions to see if the readings change.

3.06 In removing the ammeter, if jaws are hard to get open at high currents, jar the jaws against the cable at instant of opening.

4. AMMETER IN PLACE OF FUSE (AC OR DC)

4.01 It is sometimes convenient to bridge a properly fused ammeter of proper range across the fuse clips and then remove the fuse for the few seconds necessary to read the current. Where connections are made with clips, they should be large enough, not only to handle the current, but also to make accidental disconnection unlikely.

Caution: Be sure the working fuse removed is the one paralleled by the temporary fuse and ammeter.

4.02 In the case of fuse and switch units, the use of a temporary fuse in series with the ammeter is not necessary, as the circuit is protected by the other fuse.

4.03 Fig. 1 shows a suggested means of assuring dependable connections when using an ammeter shunt. If necessary to support the weight of the shunt and copper details, or if the shunt applique unit is to remain in place for some time to permit several readings, a fuse clip clamp is suggested to hold the copper details in the fuse clips.

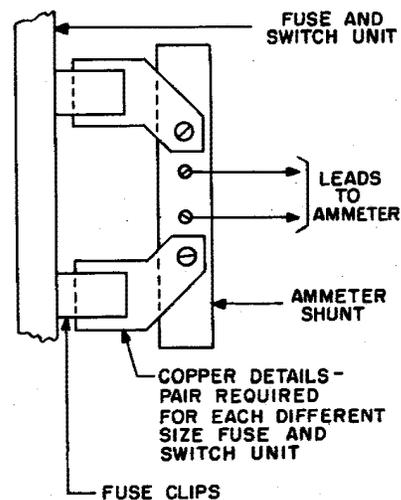


Fig. 1 - Shunt Applique for Fuse and Switch Unit

5. SUPPLEMENTARY LOAD ON FUSE (DC ONLY)

5.01 It will sometimes be convenient to add a supplementary load of known value to the fuse and calculate the regular load by comparing the voltage drop in the fuse when carrying regular load only and when carrying the regular load plus the supplementary load.

5.02 The supplementary load should be about 5 to 10 per cent of the fuse rating. Smaller supplementary loads result in less dependable estimates. Larger supplementary loads may overload the fuse if the regular load is near fuse rating. The desired supplementary current may be arrived at by using a rheostat as shown in Fig. 2 or with a fixed resistance of the value shown in the following table. Resistance values are not listed in the table for smaller fuses or for fuses of the size usually located in fuse and switch units since with such fuses, the procedure per Part 4 seems more convenient. The tapped resistor should not be used for more than 15 seconds out of each 90 seconds. Avoid burns from hot resistors.

Circuit Volts	Fuse Amps	5-10% Amps	Resis Ohms
24	60	3-6	4.2(2.1+2.1)
24	100	5-10	4.2(2.1+2.1)
24	200	10-20	2.1(2.1)
48	60	3-6	9(2.1+2.1+4.8)
48	100	5-10	9(2.1+2.1+4.8)
48	200	10-20	4.2(2.1+2.1)
130	60	3-6	24(2.1+2.1+4.8+15)
130	100	5-10	24(2.1+2.1+4.8+15)

5.03 For this test, connect in series between the load side of the fuse and ground, a switch, a rheostat or resistor of suitable capacity, and a dc ammeter of required range. See Fig. 2.

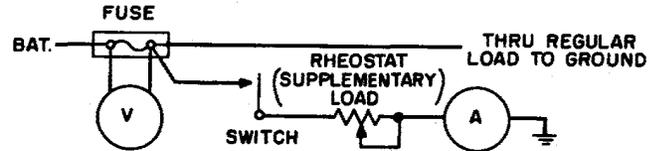


Fig. 2 - Test Circuit

Caution: Since blowing the circuit fuse while the voltmeter is connected across it would cause serious damage to the voltmeter, the voltmeter should be connected only after the supplementary load has been connected and adjusted and then for as short a time as necessary.

5.04 Close the switch and read the supplementary current I_2 if resistor is used or adjust I_2 to a value from 5 to 10 percent of fuse rating if rheostat is used. Connect voltmeter across the circuit fuse and read voltage drop E_2 . (This is due to flow of currents I_1 and I_2 .) Open switch and without any change in voltmeter connections at the fuse, read voltage drop E_1 . (This is due to flow of current I_1 only.) Disconnect voltmeter promptly. Solve for I_1 using the following formula.

$$I_1 = \frac{I_2 E_1}{(E_2 - E_1)} \text{ amperes}$$

I_1 = regular load current in amperes

I_2 = supplementary current in amperes

E_1 = voltage drop due to I_1

E_2 = voltage drop due to I_1 plus I_2