

REFERENCE GUIDE

IP RATING REFERENCE GUIDE FOR LEMO'S K&E SERIES CONNECTORS ●



INTRODUCTION

IP stands for **Ingress Protection**, as defined by the International Electrotechnical Commission, see international standard IEC 60529 "Degrees of protection provided by enclosures (IP Code)."

IEC 60529 outlines an international classification system for the sealing effectiveness of enclosures of electrical equipment against the intrusion of foreign bodies (e.g., tools, dust, fingers, and moisture) into the equipment. This classification system utilizes the letters IP (Ingress Protection) followed by two digits. LEMO's K and E series references an IP rating of IP 68/IP 66. The first numerical digit represents the degree of dust sealing. (6 is the digit) The second numerical digit represents the degree of water sealing.

- The IP68 represents a water sealing that can withstand submersion for up to 1 meter deep for approximately 15 to 30 minutes.
- The IP67 represents protection against temporary immersion
- The IP66 represents water sealing against jets of water.

The ingress protection rating is for the connector pair in a mated condition. There are 3 points of possible ingress for a panel mount receptacle and cable connected free plug.

1. Receptacle flange to equipment panel,
2. Receptacle and plug when mated, and
3. Cable entry at the rear of the plug.

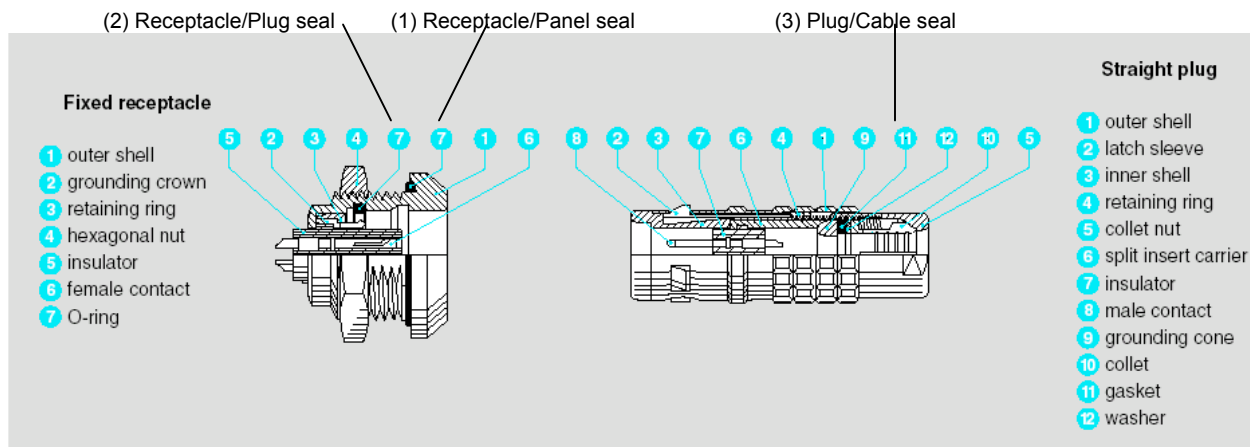


Figure #1

1. Receptacle/ Panel Seal

In order to achieve an IP 68 seal at the receptacle / panel, the panel needs to cut out to the recommended specifications in the LEMO catalog and the panel needs to be a flat surface.

2. Receptacle / Plug Seal

The ingress protection rating at this point of the mated pair is IP 68. The recessed seal in the receptacle is recessed and well protected for use. The nickel-plated tip of the plug gives an excellent mating surface to achieve the IP 68 rating. The design allows the connector pair to meet the rigorous 5,000 mating cycles typically specified for the LEMO K-series and E-series.

3. Plug / Cable seal

The plug to cable seal is the reason for the IP 68 / IP 66 dual rating. The dual rating indicates the dependence on the specific cable selected for use with the connector. The seal at the rear of the K Series and E Series is a round seal. The quality of seal is dependant on the roundness and surface of the cable. Figure #2 is an example of a coaxial cable with good roundness. The surface of the cable should also be fairly smooth. Large surface irregularities are potential paths for water ingress.

Cable Roundness

Coax cable is typically round since it is a concentric cable design. Depending on cable diameter and seal sizing an IP rating of IP67 or IP68 can be achieved.



Figure #2

Typically IP66 can be assured for most cables, and IP68 can be achieved if the cable has good fit to the rear seal of the connector. IP68 can also be achieved with rear potting of the connector/contacts.

Multi-conductor cable that has filler to create roundness can also extend beyond IP66 depending on cable diameter/seal fitting and cable sheath surface. Figure #3 is an example of a cable that has filler between the sheath and the 4 individual wires. Filled strand is typically a smaller diameter substance that fills the interstices. Filler material is an inert material that is Non-hygroscopic. Mechanical anchor material can also be included in the cable. This is common with composite electrical / fiber optic cable.



Figure #3

Filler

Multi-conductor cable without filler does not achieve a good seal between the cable and the connector rear seal. Figure #4 is an example of a multi-conductor cable with no filler and has poor roundness.

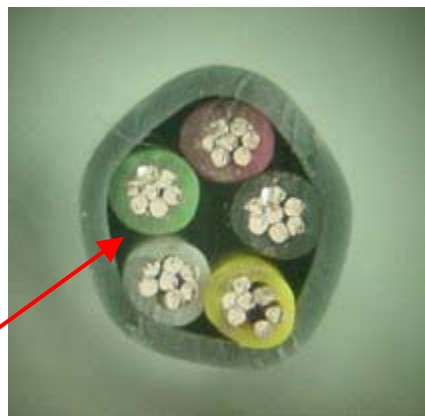


Figure #4

Air, no filler

Rear Seal

Figure #5 shows the typical rear seal of a LEMO K-series connector.

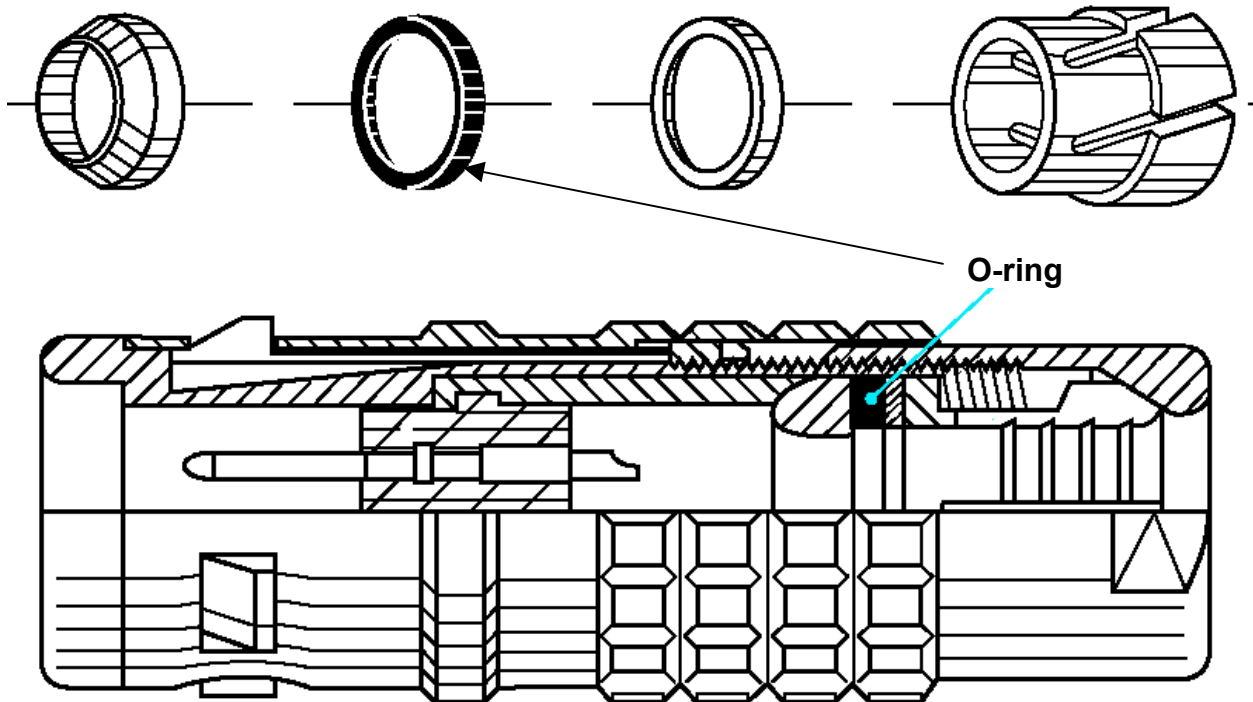
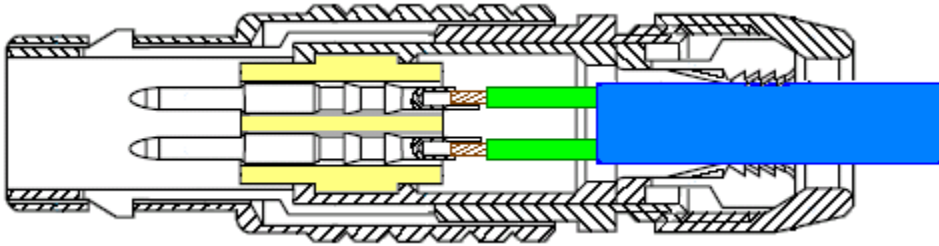
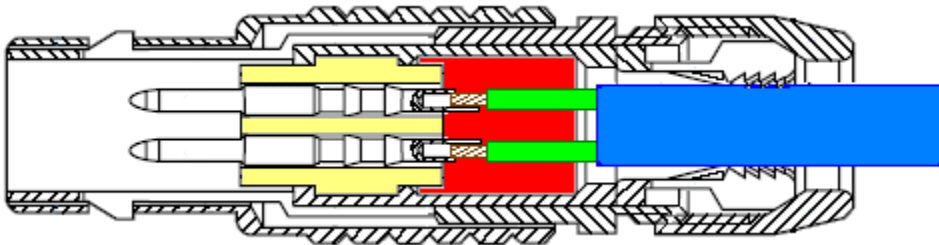


Figure #5

Potting

Protection of the contacts from water ingress can be ensured with rear potting of the connector. The potting material fills around the interconnection of the wire and the rear of each contact. The potting material also seals between the insert and the shell of the connector. Common potting materials are epoxy and silicon RTV. The process is simply to terminate the cable to the contacts/insert. Place the insert into the connector shell. Position the connector and cable vertically. Disperse the potting material into the cavity area at the rear of the connector. Do not overfill; allow space for the collet and collet nut. The potting will create an excellent water seal to protect the solder joint or wire crimp. There will be two seal barriers; the seal and the potting compound. The potting compound will be the new temperature limit of the connector system. The potting compound will limit the reparability of the connector system. An epoxy-potting compound will also limit the maximum temperature of the connector, for example LEMO potted receptacles are limited to +80°C.

Connector with cable terminated

Connector with potting (RED area)

Conclusion

There are 3 points of possible ingress for a typical panel mount receptacle and cable mounted free plug. Below is a summary of the ingress protections. The rear plug seal to cable fitting is critical for a good seal.

(1)

Panel / Receptacle seal	IP 68
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(2)

Plug / Receptacle seal	IP 68
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(3)

Plug / Cable seal	O-ring Seal	Potted Connector
Round Cable	IP 68	IP 68
Non round cable	IP 66	IP 68



635 Park Court, Rohnert Park, CA 94928
P.O. Box 2408, Rohnert Park, CA 94928-2408
(800) 444-5366 • (707) 578-8811 • fax (707) 578-0869

www.LEMOusa.com • email: info@lemousa.com