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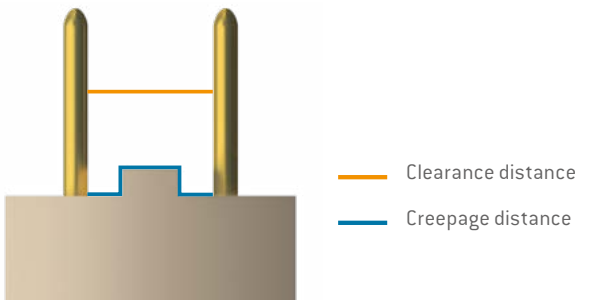
HIGH DENSITY INTERCONNECTS FOR THE MEDICAL MARKET

There continues to be a growing need for High Density connectors in the Medical environment. The need stems from applications that require high pin counts in small lightweight connector housings. Adding many pins to a connector is not a simple task. This is especially true when the connector size must be kept small. Managing this contact density becomes an engineering challenge. There are also safety regulations that have to be taken into consideration. IEC 60601-1 is the primary safety specification today concerned with the protection of the patient and operator from electrical shock.

ELECTROPHYSIOLOGY (EP) DRIVING THE DEMAND FOR HIGH DENSITY

Today Electrophysiologists use catheter systems to map the electrical signals in the heart to determine arrhythmias. Each catheter has multiple electrodes which transmit the signals from the heart back to a monitor to show the affected area of the heart allowing the Electro Physiologist to better analyze and diagnose multiple arrhythmias including Atrial Fibrillation (Afib). The more points of electrical contacts there are the better the image and in simple terms the need for a high density connector. Total pin counts can range from 60 up to 300 or more.



- **Clearance distance:** The shortest distance between two contacts outside the solid insulation
- **Creepage distance:** The shortest distance between two contacts along the surface of an insulation body

CHALLENGES IN HIGH DENSITY INTERCONNECT DESIGN

Designs for High Density connectors for the referenced (EP) applications are driven by the Medical industry and the need to comply with the safety standards as required by IEC 60601-1. Safety for the patient and the operator is critical. IEC 60601-1 has strict requirements for the spacing between electrical contacts, referred to as “creepage and clearance”.

The following graphic clearly shows the relation of clearance and creepage distances and the resulting means of protection.

Classification	Insulation	Creepage/ clearance distance	Creepage distance extension
1 MOOP[1]	1,500 V AC	2.5 mm / 2.0 mm	Basic
2 MOOP[1]	3,000 V AC	5.0 mm / 4.0 mm	Double
1 MOPP	1,500 V AC	4.0 mm / 2.5 mm	Basic
2 MOPP	4,000 V AC	8.0 mm / 5.0 mm	Double

Working voltage up to 250 V eff / Mains voltage up to 300 V AC / Overvoltage category II
[1]Pollution degree 2

Other challenges include contact insertion forces when there is high pin count and also the termination of contacts in a high density field.

While there are many standard high pin count connectors available today, they do not provide the density, light weight and ergonomics desired in the medical market and they may not comply with IEC 60601-1 safety requirements.

CUSTOM DESIGN

In most cases today it takes a custom design to use and apply the existing technologies to achieve a High Density solutions to comply with IEC 60601-1 requirements and provide the highest pin count in a small ergonomic connector that fulfills electrophysiological requirements. Design of a new High Density custom connector requires understanding the customer's application. How many contacts are required? What voltages should the connector be designed for? Will signal be combined with power? What impedance values need to be achieved? Will shielding be required? How will wire termination and cable be managed? All of these will vary for each customer application.

ODU is an established manufacturer of connectors and has many technologies to offer along with an engineering design and applications team ready to strategize with industry leaders to develop High Density connectors that comply with industry requirements and conform to the highest safety standards to protect patients and operators.

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