

# Delphi Harsh Environment Series (HES) Connection Systems

The Delphi Harsh Environment Series (HES) Connection Systems include circular connectors, terminals, and a J1939 diagnostic circular connector. The 24 shell size industry standard connector includes six terminal configurations (47, 31, 29, 23, 21, and 19) and is offered with and without back shells. Delphi's circular connection systems are available with straight and right angle conduit wire dress covers on both receptacle and plug assemblies.

The HES connection systems provide higher current capability, improved sealing, higher terminal retention and a significant cost advantage compared to standard pin-and-sleeve systems. Also, Delphi HES Connection Systems are compatible with existing systems in the commercial and agricultural vehicle markets.

### ► Benefits

- Contact (terminal) performance
  - Allows maximum current ratings compared to existing systems
  - Stainless steel sleeve provides stability and protection to contact interface area
  - Overlapping wing design provides exceptional strain relief and larger outside diameter cable range capability
  - Tin in crimp area results in superior crimp stability over life
  - Crimps designed to accommodate a wide range of cable sizes
- Sealing performance
  - Recessed ribs maintain sealing properties if a tight wire dress is applied
  - 3-rib design provides up to 50% better sealing capability compared to existing designs
  - Environmentally sealed to IP67
- Contact (terminal) retention performance
  - Robust, specialized finger design virtually eliminates terminal unseats
  - Can provide up to 40% better terminal retention when compared to existing designs
- Interchangeability
  - Male pin and female sleeve terminal cavity compatible with all industry pin and sleeve connections
  - Validated for interchangeability with industry standard products
  - Frontward / backward compatibility
  - Interchangeable cavity plugs
  - Both straight and right angle wire dress covers



HES 24 shell circular connector



HES J1939 diagnostic connector

- Ergonomics
  - Arrows help simplify pre-engagement of locking nut for simplified mating
  - Window provides visual verification of lock engagement
  - Color coded seals to distinguish between various cable diameters as well as terminal gender
  - Cavity identifications on mating and plugging ends of both receptacle and plug assemblies
  - Terminals and seals designed for easy insertion
- Robust Construction
  - Rugged construction to withstand harsh environments
  - Sonic welded design provides 360 degrees of contact to withstand high vibration to meet SAE J2030 standards
  - Wave spring included to ensure face seal compression and lock retention
- Validated to SAE J2030 and various other customer specifications

▶ **Typical Applications**

Delphi Harsh Environment Series Connection Systems are suited for the following industries:

- Agriculture
- Commercial vehicle
- Construction
- Marine
- Other harsh environment applications

They are ideally suited for making connections in a vehicle sheet metal firewall pass-through location. They are especially useful in engine compartments, though they are intended for use in any high density, in-line application. They can also be tailored to meet individual customer specifications.

▶ **Specifications**

Contacts	Size 20 (1.0 mm) Size 16 (1.6 mm) Size 12 (2.4 mm)
Application Tooling	Delphi tooling available for each current configuration
Sealing Plugs	Size 20 and 16 Size 12
Operating Temperature	-55°C to +125°C
Durability	No electrical or mechanical defects after 100 cycles of engagement or disengagement (1000 cycles for the diagnostic connector)
Physical Shock	Withstands 50 Gs of mechanical shock in three axes without mechanical failure
Vibration	Sinusoidal vibration of 20 GRMS and random vibration of 12.4 GRMS without physical damage or loss of continuity
Sealing Capability	IP67 rating Withstands high pressure spray of 375 cycles of 1020 psi @ 150 gallons/hour Withstands water submersion of 3 feet without water intrusion
Corrosion Resistance	No corrosion after exposure to 100 hours of salt fog
<b>Electrical</b>	
Contact Current Rating	Contact Size:   Max. Current (Amps): Size 20           18 Size 16           28 Size 12           40
Contact Resistance	10 mΩ for cable ≤ 18 Ga. 6.7 mΩ for cable > 16 Ga.
Dielectric Withstanding Voltage	1000 V AC
Insulation Resistance	Greater than 20 MΩ

<b>Mechanical</b>	
Contact Retention to Housing	Contact Size: Retention Force: Size 20 160 N Size 16 270 N Size 12 365 N
Mating Torque	Less than 4 Nm
Un-mating Torque	Less than 4 Nm
<b>Physical</b>	
Housing	Glass filled nylon
Seals	Silicone
Contact	Copper alloy
Female Terminal Hood	Stainless steel
Plating	Nickel and gold with tin in crimp area

► **Terminal Current Capacity and Wire Size**

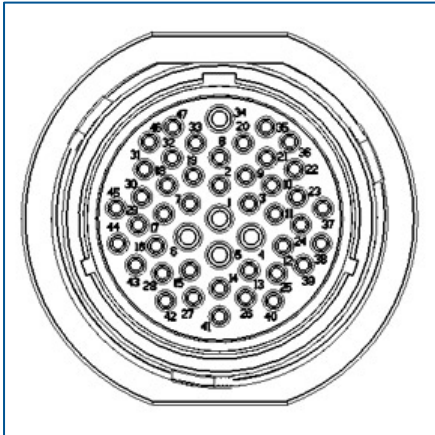
Contact Size	Wire Gauge AWG (mm <sup>2</sup> )	Current (Amps)
20	22 Ga. (0.35 mm <sup>2</sup> )	10
	20 Ga. (0.50 mm <sup>2</sup> )	14
	18 Ga. (0.80 mm <sup>2</sup> )	16
	16 Ga. (1.0 mm <sup>2</sup> )	18
16	20 Ga. (0.50 mm <sup>2</sup> )	14
	18 Ga. (0.80 mm <sup>2</sup> )	18
	16 Ga. (1.0 mm <sup>2</sup> )	22
	14 Ga. (2.0 mm <sup>2</sup> )	24
	12 Ga. (3.0 mm <sup>2</sup> )	28
12	14 Ga. (2.0 mm <sup>2</sup> )	24
	12 Ga. (3.0 mm <sup>2</sup> )	30
	4.0 mm <sup>2</sup>	30
	10 Ga. (5.0 mm <sup>2</sup> )	40

► **HES Terminal Cross Reference**

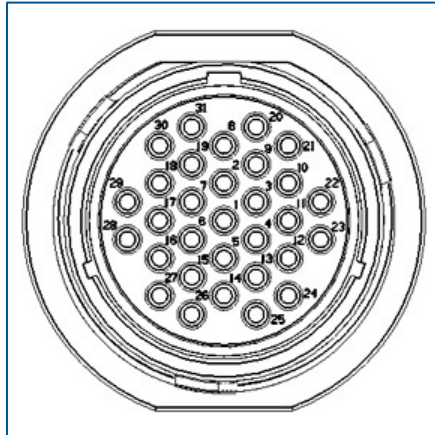
HES Part Number		Terminal Size (mm)	Terminal Type (M/F)	Wire Gage Size (mm <sup>2</sup> )	Insulation Type	Cable OD Range (mm)	Pull Strength (N)	Supplier Part Number (Ni)	Supplier Part Number (Au)
Nickel (Ni)	Gold (Au)								
13711546	13711547	1.0	F	0.35 - 0.50	TXL	1.25 - 1.80	50 / 75	1062-20-0222	1062-20-0244
13654421	13654422	1.0	F	0.35 - 0.50	G/SXL	1.80 - 2.51	50 / 75	1062-20-0122	1062-20-0144
13711548	13711549	1.0	F	0.75 - 1.00	TXL	1.60 - 2.25	90 / 120	1062-20-0222	1062-20-0244
13663727	13663728	1.0	F	0.75 - 1.00	G/SXL	2.05 - 2.78	90 / 120	1062-20-0122	1062-20-0144
13711542	13711543	1.0	M	0.35 - 0.50	TXL	1.25 - 1.80	50 / 75	1060-20-0222	1060-20-0244
13654423	13654424	1.0	M	0.35 - 0.50	G/SXL	1.80 - 2.51	50 / 75	1060-20-0122	1060-20-0144
13711544	13711545	1.0	M	0.75 - 1.00	TXL	1.60 - 2.25	90 / 120	1060-20-0222	1060-20-0244
13663723	13663724	1.0	M	0.75 - 1.00	G/SXL	2.05 - 2.78	90 / 120	1060-20-0122	1060-20-0144
13697414	13697417	1.6	F	0.50 - 0.80	TXL	1.40 - 2.15	75 / 90	1062-16-0622	1062-16-0644
13663718	13690835	1.6	F	0.50 - 0.80	G/SXL	2.20 - 2.78	75 / 90	1062-16-0122	1062-16-0144
13697415	13697418	1.6	F	1.00 - 1.50	TXL	1.80 - 2.45	120	1062-16-0622	1062-16-0644
13663719	13690836	1.6	F	1.00 - 1.50	G/SXL	2.40 - 3.00	120	1062-16-0122	1062-16-0144
13697416	13697419	1.6	F	2.00 - 3.00	TXL	2.40 - 3.31	180 / 240	1062-16-0722	1062-16-0744
13663720	13690837	1.6	F	2.00 - 3.00	G/SXL	2.89 - 3.67	180 / 240	1062-14-0122	1062-14-0144
13697408	13697411	1.6	M	0.50 - 0.80	TXL	1.40 - 2.15	75 / 90	1060-16-0622	1060-16-0644
13663715	13690838	1.6	M	0.50 - 0.80	G/SXL	2.20 - 2.78	75 / 90	1060-16-0122	1060-16-0144
13697409	13697412	1.6	M	1.00 - 1.50	TXL	1.80 - 2.45	120	1060-16-0622	1060-16-0644
13663716	13690839	1.6	M	1.00 - 1.50	G/SXL	2.40 - 3.00	120	1060-16-0122	1060-16-0144
13697410	13697413	1.6	M	2.00 - 3.00	TXL	2.40 - 3.31	180 / 240	1060-16-0722	1060-16-0744
13663717	13690840	1.6	M	2.00 - 3.00	G/SXL	2.89 - 3.67	180 / 240	1060-14-0122	1060-14-0144

\*\* 2.4 mm terminals (Size 12) to be available at a later date (2011)

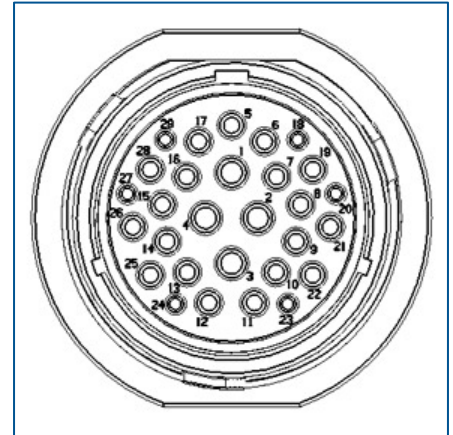
▶ **HES 24 Shell Terminal Patterns**



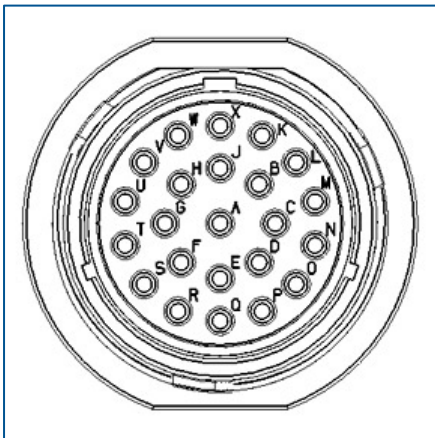
**47 Way**  
 42 size 20  
 5 size 16  
 Thin wall (blue seal)



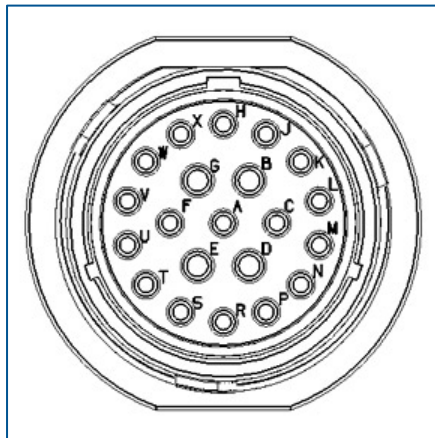
**31 Way**  
 31 size 16  
 Thin wall (blue seal)  
 Regular/heavy wall (orange seal)



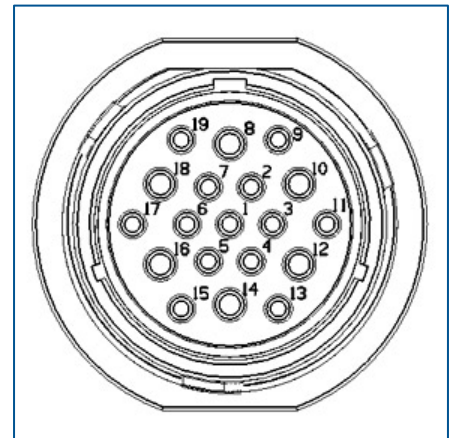
**29 Way**  
 6 size 20  
 19 size 6  
 4 size 12  
 Thin wall (blue seal)  
 Regular/heavy wall (orange seal)



**23 Way**  
 23 size 16  
 Thin wall (blue seal)  
 Regular/heavy wall (orange seal)



**21 Way**  
 17 size 16  
 4 size 12  
 Thin wall (blue seal)  
 Regular/heavy wall (orange seal)



**19 Way**  
 13 size 16  
 6 size 12  
 Thin wall (blue seal)  
 Regular/heavy wall (orange seal)

► **HES Circular Connector Assemblies — Standard Configuration**

Number of Cavities	Cable Type - Seal Color *	Regular Or Wire Dress	Part Number (Receptacle Plastic Male Terminals)	Part Number (Plug Plastic Female Terminals)
47	TXL - blue	Regular	13653493	13653492
	TXL - blue	Wire dress	13719103	13719104
31	TXL - blue	Regular	13667925	13667935
	G/SXL - orange	Regular	13698338	13698339
	TXL - blue	Wire dress	13719105	13719106
	G/SXL - orange	Wire dress	13719107	13719108
23	TXL - blue	Regular	13697104	13697105
	G/SXL - orange	Regular	13698342	13698343
	TXL - blue	Wire dress	13719113	13719114
	G/SXL - orange	Wire dress	13719115	13719116
29	TXL - blue	Regular	13697106	13697107
	G/SXL - orange	Regular	13698344	13698345
	TXL - blue	Wire dress	13719109	13719110
	G/SXL - orange	Wire dress	13719111	13719112
21	TXL - blue	Regular	13697102	13697103
	G/SXL - orange	Regular	13698340	13698341
	TXL - blue	Wire dress	13719117	13719118
	G/SXL - orange	Wire dress	13719119	13719121
19	TXL - blue	Regular	13697108	13697109
	G/SXL - orange	Regular	13698346	13698347
	TXL - blue	Wire dress	13719123	13719124
	G/SXL - orange	Wire dress	13719125	13719126

► **HES Circular Connector Assemblies — Reverse Configuration**

Number of Cavities	Cable Type - Seal Color *	Regular or Wire Dress	Part Number (Receptacle Plastic Female Terminals)	Part Number (Plug Plastic Male Terminals)
31	TXL - blue	Regular	13765452	13765449
	G/SXL - orange	Regular	13765453	13765450
	TXL - blue	Wire dress	13765456	13765454
	G/SXL - orange	Wire dress	13765457	13765455
19	TXL - blue	Regular	13752445	13752444
	G/SXL - orange	Regular	13765451	13765447
	TXL - blue	Wire dress	13765460	13765458
	G/SXL - orange	Wire dress	13765461	13765459

\*Light seal color represents female/sleeve terminal  
 Dark seal color represents male/pin terminal

► **HES Size 24 Cable Diameter Range for Optimal Sealing Capability**

Contact Size	Thin Wall Cable	Regular and Thick Wall Cable
Size 20 (1.0)	1.10 - 2.40 mm <sup>2</sup>	1.80 - 3.05 mm <sup>2</sup>
Size 16 (1.6)	1.30 - 2.85 mm <sup>2</sup>	2.25 - 3.70 mm <sup>2</sup>
Size 12 (2.4)	2.45 - 3.60 mm <sup>2</sup>	2.90 - 4.30 mm <sup>2</sup>
Seals accommodate SAE, DIN JIS cable		

▶ **Conduit Backshell Wire Dress**

Part Number	Conduit Size	Configuration
13767802	19	Wire dress straight
13767803	22	
13667839	25	
13767805	19	Wire dress right angle
13767806	22	
13667840	25	

▶ **Cavity Seal Plugs**

Part Number	Terminal Cavity
13756464	Size 20 and 16
13756465	Size 12

▶ **Miscellaneous Accessories**

Part Number	Description
13780240	Gasket
13813956	Gasket with adhesive
13752446	Shipping cover (reverse pin cover)
13668988	Shipping cover (standard pin cover)
15417623	Nut
13519631	Lock washer



**HES non-threaded backshell conduit adaptors**



**HES plugs**

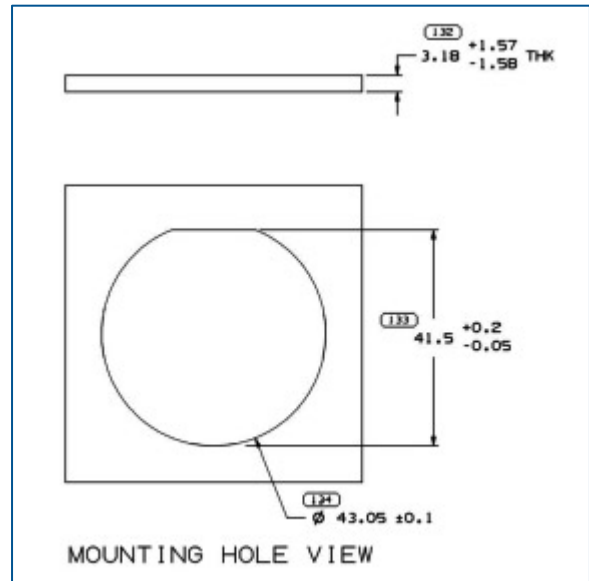


▶ **Diagnostic Connector**

Part Number	Description	Cable Range Outside Diameter (mm)
13690621	Assembly without dust cap	2.1 - 4.9
13667277	Dust cap	



HES J1939 diagnostic connector (left) and dust cap (right)



Mounting hole view for the HES diagnostic connector



HES 24 shell circular connector



HES terminal