

# Delphi Harsh Environment Series (HES) Connection Systems

The Delphi Harsh Environment Series (HES) Connection Systems include circular connectors, terminals, and a rectangular 50 and 60 way header. The 24 shell size industry standard connector includes six terminal configurations (47, 31, 29, 23, 21, and 19). 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. Delphi HES Connection Systems are also compatible with existing systems in the commercial and agricultural vehicle markets.

### ► Benefits

#### • Terminals

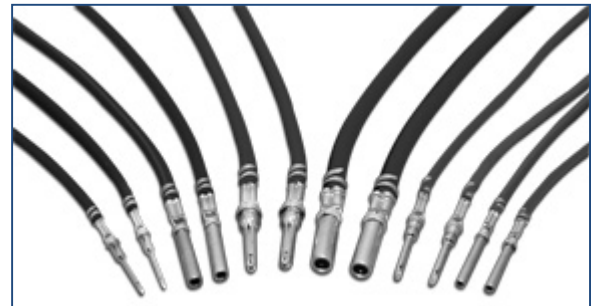
- High current performance is realized through the selection of high conductive materials
- Robust design with a stainless steel sleeve that provides stability and protection to contact interface area
- Overlapping wing design provides exceptional strain relief and larger outside diameter cable range capability
- Crimp stability over the terminal life with the use of tin in the crimp area
- Wide range of cable sizes accommodated with Delphi's crimp design
- Interchangeability with industry standard terminal products

#### • HES Circular Connectors

- Sealing performance exceeds expectations with recessed 3-rib design that will maintain sealing properties even if a tight wire dress is applied, providing better sealing capability up to 30% compared to existing designs
- Superior contact (terminal) retention performance virtually eliminates terminal unseats with a specialized finger design that results in better retention up to 40% when compared to existing designs
- Interchangeability with industry standard circular products
- Ergonomic design for ease of assembly and to maintain quality:
  - Arrows help simplify pre-engagement of locking collar for simplified mating
  - Visual lock engagement window
  - Color coded seals to distinguish between various cable diameters as well as terminal gender
  - Low torque engage
- Robust construction through sonic welding the seal retainer construction and using wave spring design that ensures the connection system maintains face seal compression, even when subjected to the high vibration commercial vehicle SAE J-2030 standard



HES Connection Systems



HES Terminals

- **Header System**

- Virtually eliminates unseats with Delphi's two stage terminal retainer design
- High vibration design passes 29 Grms vibration specification
- Chemical resistant header face seals with the use of flourosilicone
- Built-in probing window protect the female terminal during the build process
- Over-torque bolt design protects the header when too much torque is applied
- True pin position is one of the tightest in the industry at 0.225 mm, ensuring easy mounting to a circuit board
- Interchangeability with industry standard products

► **Typical Applications**

Delphi Harsh Environment Series products are suited for the following industries:

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

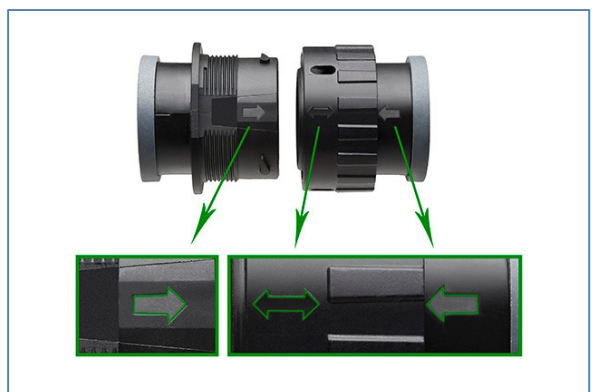
The HES circular design is ideally suited for making connections in a vehicle sheet metal firewall pass-through locations. Because of the rugged connection system design, they are well suited for engine compartments. HES headers are an ideal choice for high density device I/Os that are mounted directly to the engine.



**HES Circular Connectors**



**HES Header System**

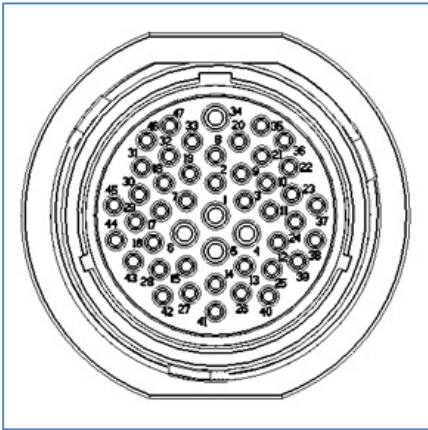


**Arrows help simplify pre-engagement of locking collar for simplified mating**

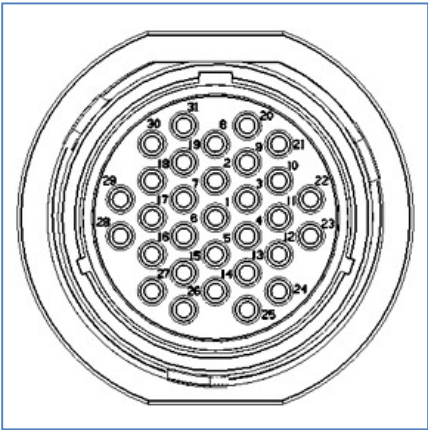
► **Specifications for Connectors and Terminals**

|                                 |                                                                                                                                                        |                      |                |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------|
| Contacts                        | Size 20 (1.0 mm)<br>Size 16 (1.6 mm)<br>Size 12 (2.4 mm)                                                                                               |                      |                |
| Application Tooling             | Delphi tooling available for each current configuration                                                                                                |                      |                |
| Sealing Plugs                   | Size 20 and 16<br>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<br>Withstands high pressure spray of 375 cycles of 1020 psi @ 150 gal/hr.<br>Withstands water submersion of 3 feet without water intrusion |                      |                |
| Cable Range for Optimal Sealing | Contact size:                                                                                                                                          | Blue Seal:           | Orange Seal:   |
|                                 | Size 20 (1.0)                                                                                                                                          | 1.10 - 2.40 mm       | 1.80 - 3.05 mm |
|                                 | Size 16 (1.6)                                                                                                                                          | 1.30 - 2.85 mm       | 2.25 - 3.70 mm |
|                                 | Size 12 (2.4)                                                                                                                                          | 2.45 - 3.60 mm       | 2.90 - 4.30 mm |
| Corrosion Resistance            | No corrosion after exposure to 100 hrs 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.<br>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                                                                                                                 |                      |                |

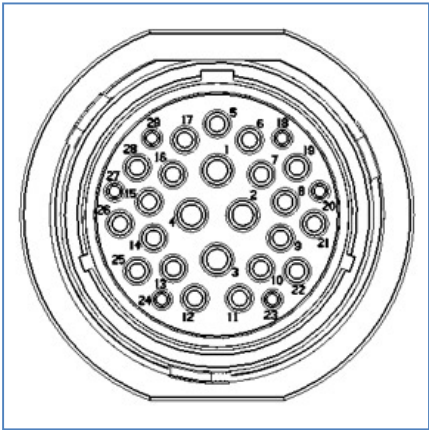
► HES 24 Shell Terminal Patterns



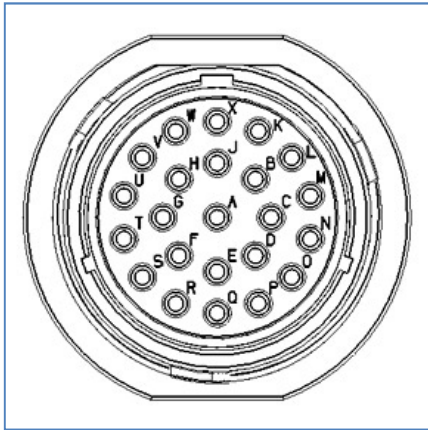
47 Way  
42 size 20  
5 size 16  
Thin wall (blue seal)



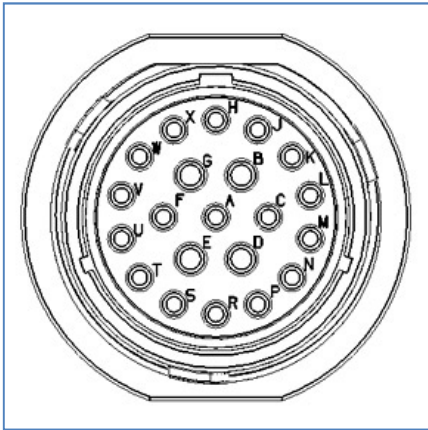
31 Way  
31 size 16  
Thin wall (blue seal)  
Regular/heavy wall (orange seal)



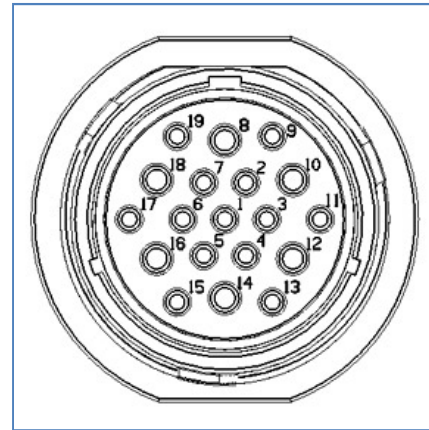
29 Way  
6 size 20  
19 size 16  
4 size 12  
Thin wall (blue seal)  
Regular/heavy wall (orange seal)



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)



19 Way  
13 size 16  
6 size 12  
Thin wall (blue seal)

► **HES Assembly Part Numbers — Standard Configuration**

| Description – HES Assembly | New Part Number | Old Part Number (backshell, non-backshell) | New Mating Part Number |
|----------------------------|-----------------|--------------------------------------------|------------------------|
| 47 Way M Asm Thin          | 15544324        | 13719103, 13653493                         | 15544892               |
| 47 Way F Asm Thin          | 15544892        | 13719104, 13653492                         | 15544324               |
| 31 Way M Asm Thin          | 15544325        | 13719105, 13667925                         | 15544893               |
| 31 Way M Asm Thick         | 15544326        | 13719107, 13698338                         | 15544894               |
| 31 Way F Asm Thin          | 15544893        | 13719106, 13667935                         | 15544325               |
| 31 Way F Asm Thick         | 15544894        | 13719108, 13698339                         | 15544326               |
| 29 Way M Asm Thin          | 15544327        | 13719109, 13697106                         | 15544895               |
| 29 Way M Asm Thick         | 15544328        | 13719111, 13698344                         | 15544896               |
| 29 Way F Asm Thin          | 15544895        | 13719110, 13697107                         | 15544327               |
| 29 way F Asm Thick         | 15544896        | 13719112, 13698345                         | 15544328               |
| 23 Way M Asm Thin          | 15544329        | 13719113, 13697104                         | 15544897               |
| 23 Way M Asm Thick         | 15544330        | 13719115, 13698342                         | 15544898               |
| 23 Way F Asm Thin          | 15544897        | 13719114, 13697105                         | 15544329               |
| 23 Way F Asm Thick         | 15544898        | 13719116, 13698343                         | 15544330               |
| 21 Way M Asm Thin          | 15544331        | 13719117, 13697102                         | 15544899               |
| 21 Way M Asm Thick         | 15544332        | 13719119, 13698340                         | 15544901               |
| 21 Way F Asm Thin          | 15544899        | 13719118, 13697103                         | 15544331               |
| 21 Way F Asm Thick         | 15544901        | 13719121, 13698341                         | 15544332               |
| 19 Way M Asm Thin          | 15544333        | 13719123, 13697108                         | 15544902               |
| 19 Way M Asm Thick         | 15544334        | 13719125, 13698346                         | 15544903               |
| 19 Way F Asm Thin          | 15544902        | 13719124, 13697109                         | 15544333               |
| 19 Way F Asm Thick         | 15544903        | 13719126, 13698347                         | 15544334               |

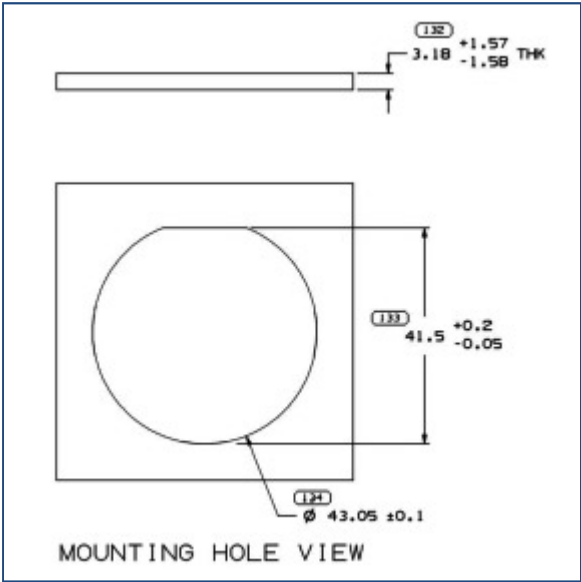
► **HES Assembly Part Numbers — Reverse Configuration**

| Description – HES Assembly | New Part Number | Old Part Number (backshell, non-backshell) | New Mating Part Number |
|----------------------------|-----------------|--------------------------------------------|------------------------|
| 31 Way M Asm Thin          | 15544343        | 13765454, 13765449                         | 15544348               |
| 31 Way M Asm Thick         | 15544344        | 13765455, 13765450                         | 15544349               |
| 31 Way F Asm Thin          | 15544348        | 13765456, 13765452                         | 15544343               |
| 31 Way F Asm Thick         | 15544349        | 13765457, 13765453                         | 15544344               |
| 19 Way M Asm Thin          | 15544345        | 13765458, 13752444                         | 15544350               |
| 19 Way M Asm Thick         | 15544346        | 13765459, 13765447                         | 15544351               |
| 19 Way F Asm Thin          | 15544350        | 13765460, 13752445                         | 15544345               |
| 19 Way F Asm Thick         | 15544351        | 13765461, 13765451                         | 15544346               |

Light seal color represents female/sleeve terminal

Dark seal color represents male/pin terminal

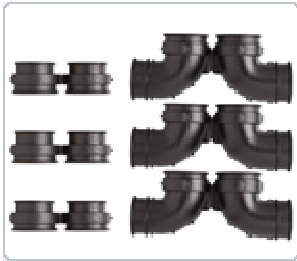




Mounting specification for the HES size 24 receptacle

► 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           |                        |



HES non-threaded backshell conduit adaptors

► 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                                 |
| 13840220    | Lock washer                         |



HES plugs

► **Specifications for the 50/60 Way Header Connections**

| Contacts                     | Size 20 (1.0 mm)                                                                                                 |
|------------------------------|------------------------------------------------------------------------------------------------------------------|
| Sealing Plugs                | Size 20 (Note: Different part number than HES circulars)                                                         |
| Operating Temperature        | - 55°C to + 125°C                                                                                                |
| Physical Shock               | Withstands 50 Gs of mechanical shock in three axes without mechanical failure                                    |
| Vibration                    | 29.4 Grms                                                                                                        |
| Sealing Capability           | IPX7                                                                                                             |
| Corrosion Resistance         | No corrosion after exposure to 100 hours of salt fog<br>Chemical resistant flourosilicon face seal on the header |
| Electrical                   |                                                                                                                  |
| Contact Current Rating       | Size 20: 18 amps maximum current                                                                                 |
| Contact Plating              | Selective gold with tin in crimp area on the female contact<br>Gold flash palladium on the header pins           |
| Mechanical                   |                                                                                                                  |
| Contact Retention to Housing | Contact size:      Retention force:<br>Size 20              90 N                                                 |
| Physical                     |                                                                                                                  |
| Housing                      | High temperature, glass filled nylon                                                                             |
| Seals                        | Flourosilicone face seals<br>Silicone cable seals                                                                |
| Contact                      | Copper alloy                                                                                                     |
| Plating                      | Female: Gold with tin in crimp area<br>Male: Gold flash palladium                                                |

► **HES 50-way Header System**

| Top Mount Header<br>Part Number                                                     | Female Plug Connector<br>Part Number                                                | Index |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------|
|  |  |       |
| 13836626                                                                            | 13837191                                                                            | 1     |
| 13836627                                                                            | 13837192                                                                            | 2     |
| 13836628                                                                            | 13837193                                                                            | 3     |
| 13836629                                                                            | 13837194                                                                            | 4     |
| 13836630                                                                            | 13837195                                                                            | 5     |
| 13936631                                                                            | 13837196                                                                            | 6     |
| 13636632                                                                            | 13837197                                                                            | 7     |
| 13636633                                                                            | 13837198                                                                            | 8     |
| 13836634                                                                            | 13837199                                                                            | 9     |
| 13836635                                                                            | 13837200                                                                            | 10    |

▶ **HES 60-Way Header System**

| Bottom Flange Mount Header Part Number                                            | Top Mount Header Part Number                                                      | Female Plug Connector Part Number                                                  | Index |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------|
|  |  |  |       |
| Available upon request                                                            | 13836616                                                                          | 13837180                                                                           | 1     |
| Available upon request                                                            | 13836617                                                                          | 13837181                                                                           | 2     |
| Available upon request                                                            | 13836618                                                                          | 13837182                                                                           | 3     |
| Available upon request                                                            | 13836619                                                                          | 13837183                                                                           | 4     |
| 13806062                                                                          | 13836620                                                                          | 13837184                                                                           | 5     |
| 13806064                                                                          | 13836621                                                                          | 13837185                                                                           | 6     |
| 13806065                                                                          | 13836622                                                                          | 13837186                                                                           | 7     |
| Available upon request                                                            | 13836623                                                                          | 13837187                                                                           | 8     |
| Available upon request                                                            | 13836624                                                                          | 13837188                                                                           | 9     |
| Available upon request                                                            | 13836625                                                                          | 13837189                                                                           | 10    |

▶ **Miscellaneous HES 50/60 Way Header Accessories**

| Part Number | Description      |
|-------------|------------------|
| 15475969    | Backshell 60-way |
| 15475968    | Backshell 50-way |
| 12129557    | Cavity plug      |



**HES Header Accessory**

▶ **The Delphi Advantage**

Delphi is one of the world's leading automotive suppliers of advanced terminals, connectors, sealing, wiring and cable products. Delphi's deep understanding of various connection system technologies and the company's vast research and development capabilities have enabled continuing innovation.

Delphi is a source for high value solutions and our expertise is built into every product. Delphi has a thorough understanding of markets around the world and a global network of resources. Delphi relies on its global capabilities, consistent processes, and extensive testing to develop and manufacture a comprehensive offering of terminals, connectors, sealing, wiring and cable products. The result is that Delphi provides customers with robust, reliable products and world-class quality.



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