

# HIGH VOLTAGE AK FAMILY OVERVIEW



• APTIV •

# Content

## Why HV AK Products?

Market environment and value proposition

## Portfolio Overview

Portfolio scope

## Technical Overview & Part Numbers

AK  
Class 1

AK  
Class 4

AK  
Pass-throughs

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## Why HV AK Products?

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# The Challenge

A standardized interconnection system for high voltage products

Cost competitive solutions for growing volumes of hybrid and electric vehicles.

Meeting specific technical requirements regarding vibrations and temperature for hybrid vehicles.

# The Solution

**Presenting the High Voltage AK family.**

**A standard interface meeting the more demanding requirements of hybrid vehicles.**

**In addition, the AK family is a cost-effective solution for the quickly increasing high voltage transportation market.**



# Robust features, meaningful benefits

## Compatible solution with a standard interface

- Recognized and proven AK LV214 & LV215 standard
- Available versions
  - AK Class 1
  - AK Class 4
  - AK Pass-through
- Fully compatible with other supplier's solutions

## Higher Robustness

- According to LV214 standard
  - Vibrations up to severity 3 (engine profile)
  - Temperature severity 4 (-40 to 140°C)
- Designed with innovative cable strain relief for higher vibrations

## Designed for high volume applications

- Cost-effective solution
  - Simplified ferrule designs
  - Designed for an easier cable assembly which creates faster processes and high quality repeatability
- Able to meet high volume applications
  - High installed capacity
  - Resulting in a flexible service with a valued reactivity

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# Versatility of application

HV PTC Heater

AC/DC inverter

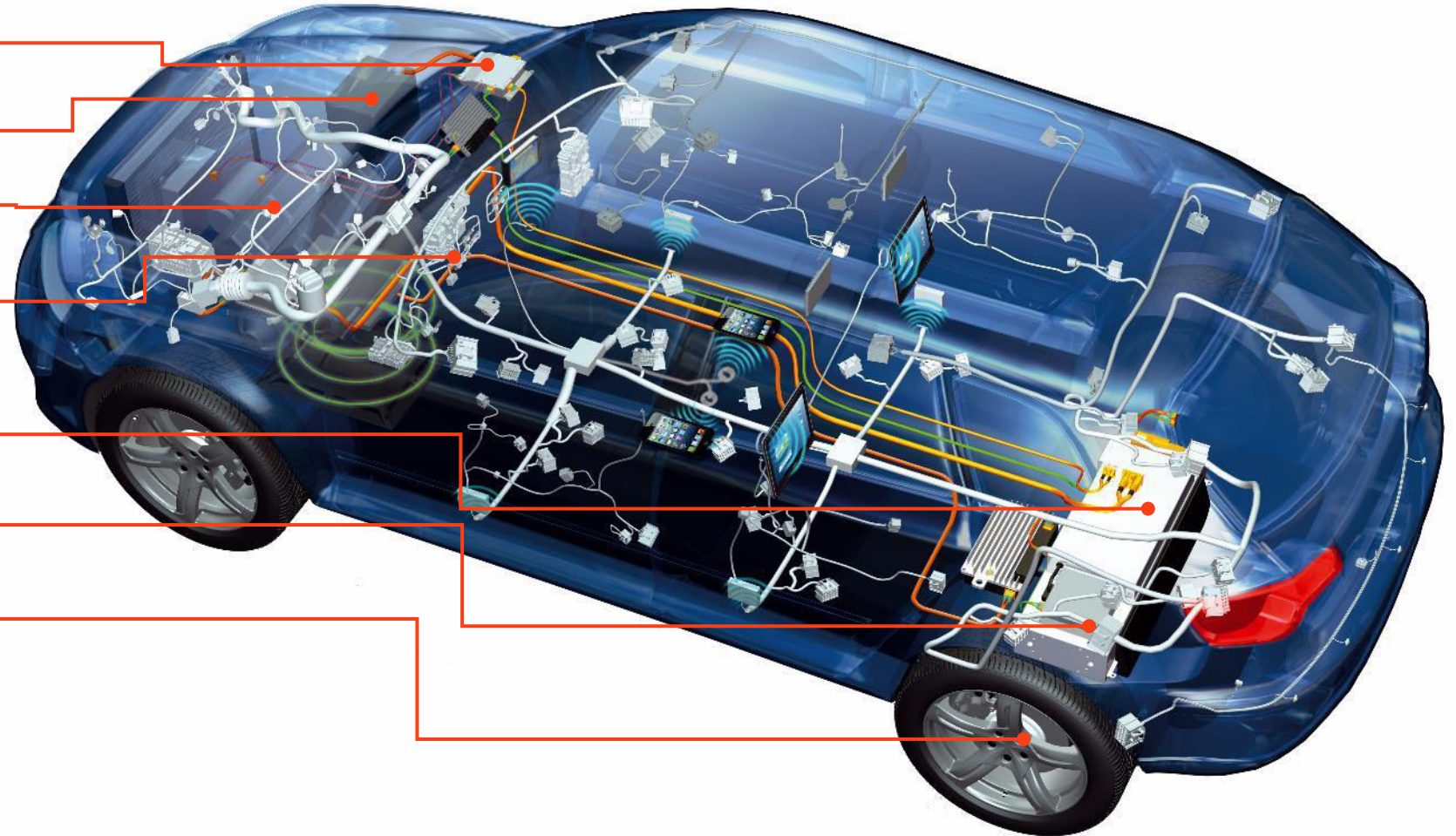
Front e-motors

HV Air-conditioning

HV Battery

On-board charger

In-wheel e-motors





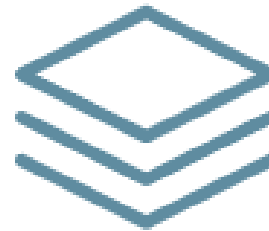
# A wide family range

## Connectors

- AK Class 1 female connectors
  - 2 way Female Connector HVIL pass-through
  - 2 way Female Connector HVIL Shunt
  - 3 way Female Connector without HVIL
- AK Class 4
  - 2 way header connector
  - 2 way Female Connector

## Pass-through

- 1 way
- 2 way
- 3 way



## Accessories

- Unique cable strain relief for high vibration applications
- Shielding ferrules
- Single-wire seals

# AK Class 1 Series



## Key features & benefits

- Standard AK interface
- High robustness against vibrations
- Multiple layouts & HVIL options in the same interface
- 2 & 3 way connector, 280 terminal system and 0,64 HVIL
  - 2-way with shunt on female
  - 2-way with in-line HVIL
  - 3-way without HVIL
- Connector according AK interface specification and LV215 latest revision
- Finger proof/touch safe
- Multicore shielded cable for wiring simplification
- Fully interchangeable with other AK supplier sources

## Performance characteristics

|                                      |                                 |
|--------------------------------------|---------------------------------|
| <b>Sealing protection</b>            | IP67, IP6K9K                    |
| <b>Temperature range (up to)</b>     | -40°C to +140°C ; LV215 Level 4 |
| <b>Vibration performance (up to)</b> | LV215 Level 2                   |
| <b>Max Current</b>                   | 32A @ 85°C                      |
| <b>Max Voltage</b>                   | 1000V DC                        |



**Application: High voltage auxiliary modules such as Air conditioning, PTC heaters, Inverts, On-board-chargers**

Part numbers, specifications, dimensions and performance data in this document are for general references only and are subject to change without notice. To verify product information, please contact an Aptiv representative.

# AK Class 4 Series



## Key features & benefits

- High operating temperature
- High robustness against vibrations
- Header compatible with both Straight & Right angle female connector
- Connector and header design according to AK interface specification and LV215 latest revision
- Individual shielded cables
- Fully interchangeable with other AK supplier sources

## Performance characteristics

|                               |                                 |
|-------------------------------|---------------------------------|
| Sealing protection (up to)    | IP67, IP6K9K                    |
| Temperature range (up to)     | -40°C to +140°C ; LV215 Level 4 |
| Vibration performance (up to) | LV215 Level 3                   |
| Max Current                   | 180A @ 140°C                    |
| Max Voltage                   | 600V AC ; 1000V DC              |



**Application: High voltage / high current modules:  
inverter, battery, junction box, power electric box**

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# AK Pass-Through 1, 2 & 3 way Series



## Key features & benefits

- Very compact dimensions
- High robustness against vibrations
- Ring terminal is bolted to device
- Cables are 360° individually shielded
- High voltage panel mount system
- Fully interchangeable with other AK supplier sources

## Performance characteristics

|                                 |  |
|---------------------------------|--|
| Sealing protection (up to)      | IP67, IP6K9K                           |
| Temperature range (up to)       | -40°C to +140°C ; LV215 Level 4        |
| Vibration performance (up to)   | LV215 Level 3                          |
| Max Current                     | 200A @ 140°C depending on cable choice |
| Max Voltage                     | 1000V DC                               |
| Available cavity configurations | 1, 2, 3 way                            |



**Application: High voltage / high current modules:  
inverter, battery, junction box, power electric box**

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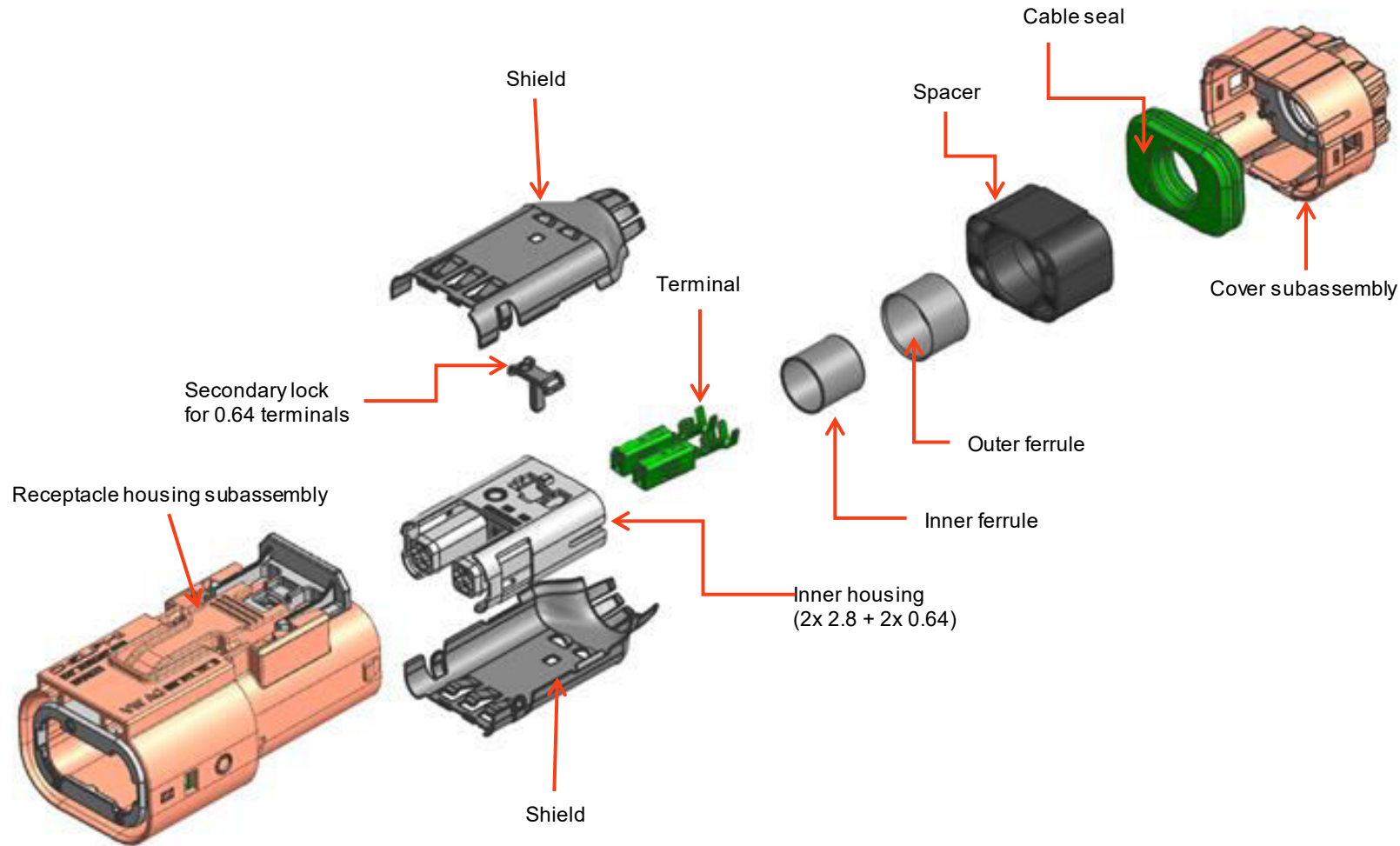
AK  
Class 1

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Pass-throughs

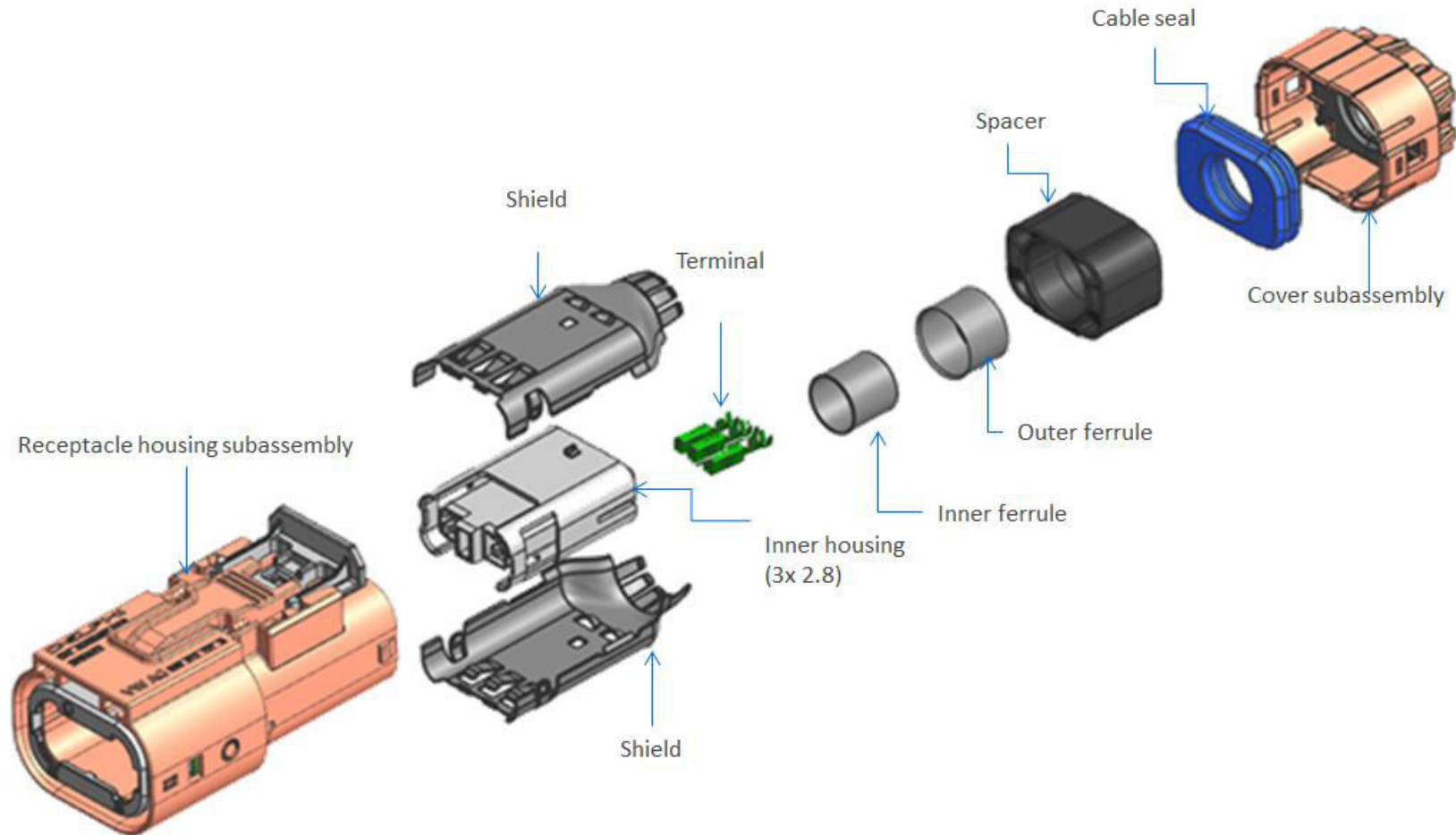
# AK Class 1 exploded view

Connector 2 way

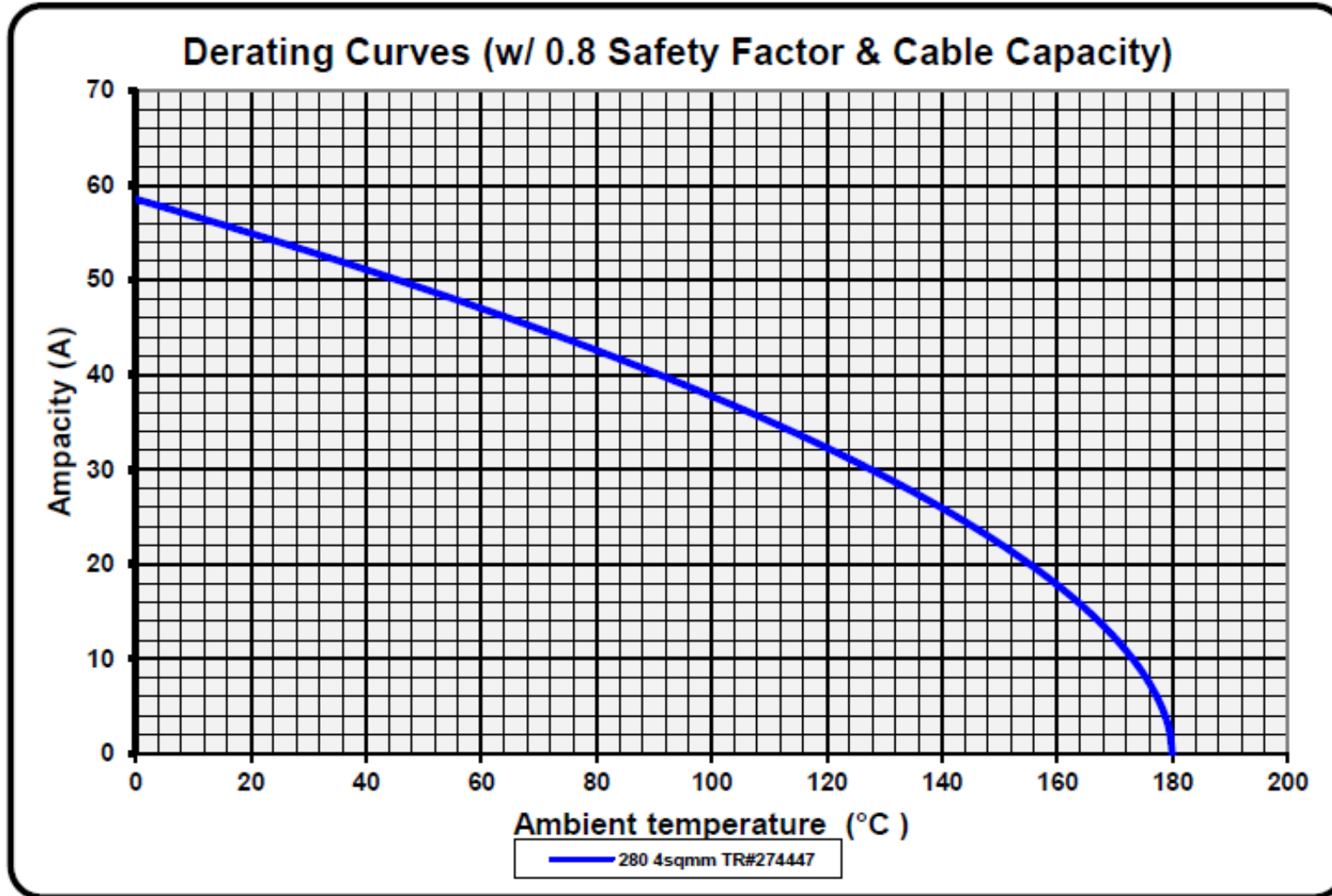


# AK Class 1 exploded view

Connector 3 way



# AK Class 1 derating curve



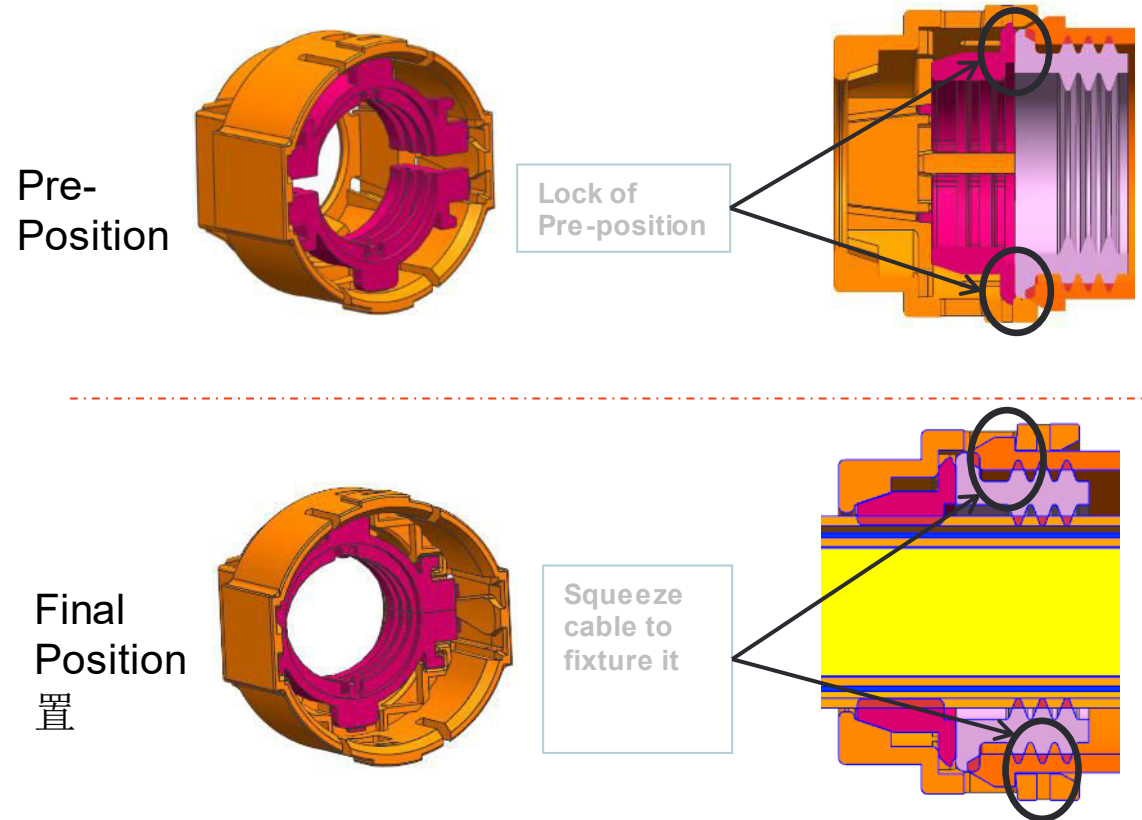
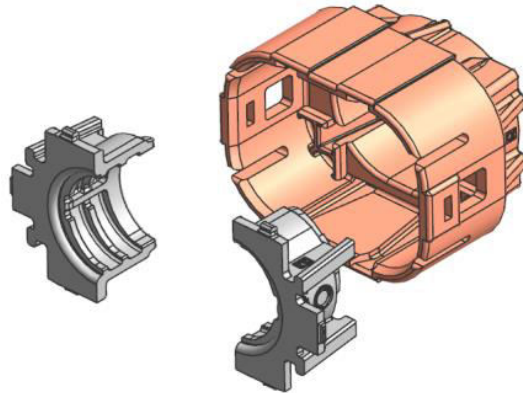


# AK Class 1 technology

## Cable strain relief innovations


### Benefits

- Aptiv Patented cable squeezer :
  - increases the reliability of the cable sealing
  - provides more robust anti-vibration performance




# AK Class 1 part numbers

## 2 way Female Connector HVIL pass-through

| AK Class 1<br>2 way Female Connector<br>HVIL pass-through                          | Description  | Part Number | BOM |
|--|--|-------------|-----|
|  | Female connector outer housing Code A  | 33372017    | 1   |
|  | Female connector outer housing Code B  | 33372014    | 1   |
|  | Female connector outer housing Code C  | 33372016    | 1   |
|  | Female connector outer housing Code D  | 33372015    | 1   |
|  | Female connector outer housing Code E  | 35061103    | 1   |
|  | Inner Housing, 2Way  | 35174511    | 1   |
|  | DCK 2.8 female terminal 4 mm <sup>2</sup>  | 33522728    | 2   |
|  | DCK 2.8 female terminal 2.5 mm <sup>2</sup>  | 33514302    | 2   |
|  | Duo tw in 0,64 male terminal 0,5 mm <sup>2</sup><br>(HVIL pass-through version only) | 33504709    | 2   |
|  | Spacer   | 35174268    | 1   |
|  | Shielding  | 35174446    | 2   |
|  | Cable Seal for 2 x 4.0 mm <sup>2</sup>   | 35174508    | 1   |
|  | Inner ferrule  | 35174280    | 1   |
|  | Outer ferrule  | 35174278    | 1   |
|  | TPA (Terminal Position Assurance)  | 35174513    | 1   |
| ASM Strain Relief for 2 x 4.0 + 2 x 0.5 mm <sup>2</sup>                            | 35174510   | 1           |     |


# AK Class 1 part numbers

## 2 way Female Connector HVIL Shunt

| AK Class 1<br>2 way Female Connector HVIL<br>Shunt                                 | Description                                   | Part Number | BOM |
|--|---|-------------|-----|
|  | Female connector outer housing Code A         | 33372017    | 1   |
|  | Female connector outer housing Code B         | 33372014    | 1   |
|  | Female connector outer housing Code C         | 33372016    | 1   |
|  | Female connector outer housing Code D         | 33372015    | 1   |
|  | Female connector outer housing Code E         | 35061103    | 1   |
|  | Inner housing 2-way HVIL shunt                | 35174509    | 1   |
|  | DCK 2.8 female terminal 4 mm <sup>2</sup>     | 33522728    | 2   |
|  | DCK 2.8 female terminal 2.5 mm <sup>2</sup>   | 33514302    | 2   |
|  | Spacer  | 35174268    | 1   |
|  | Shielding                                     | 35174446    | 2   |
|  | ASM Strain Relief for 2 x 4.0 mm <sup>2</sup> | 35174507    | 1   |
|  | Cable Seal for 2 x 4.0 mm <sup>2</sup>        | 35174508    | 1   |
|  | Inner ferrule                                 | 35174280    | 1   |
|  | Outer ferrule                                 | 35174278    | 1   |

# AK Class 1 part numbers

## 3 way Female Connector without HVIL

| AK Class 1<br>3 way Female Connector<br>without HVIL                               | Description                                   | Part Number | BOM |
|--|---|-------------|-----|
|  | Female connector outer housing Code A         | 33372017    | 1   |
|  | Female connector outer housing Code B         | 33372014    | 1   |
|  | Female connector outer housing Code C         | 33372016    | 1   |
|  | Female connector outer housing Code D         | 33372015    | 1   |
|  | Female connector outer housing Code E         | 35061103    | 1   |
|  | Inner Housing, 3Way                           | 35174448    | 1   |
|  | DCK 2.8 female terminal 4 mm <sup>2</sup>     | 33522728    | 2   |
|  | DCK 2.8 female terminal 2.5 mm <sup>2</sup>   | 33514302    | 2   |
|  | Spacer  | 35174268    | 1   |
|  | Shielding                                     | 35174446    | 2   |
|  | ASM Strain Relief for 3 x 2.5 mm <sup>2</sup> | 35174249    | 1   |
|  | Cable Seal for 3 x 2.5 mm <sup>2</sup>        | 35174250    | 1   |
|  | Inner ferrule                                 | 35174280    | 1   |
|  | Outer ferrule                                 | 35174278    | 1   |

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## Technical Overview

Design features

&

Part Numbers

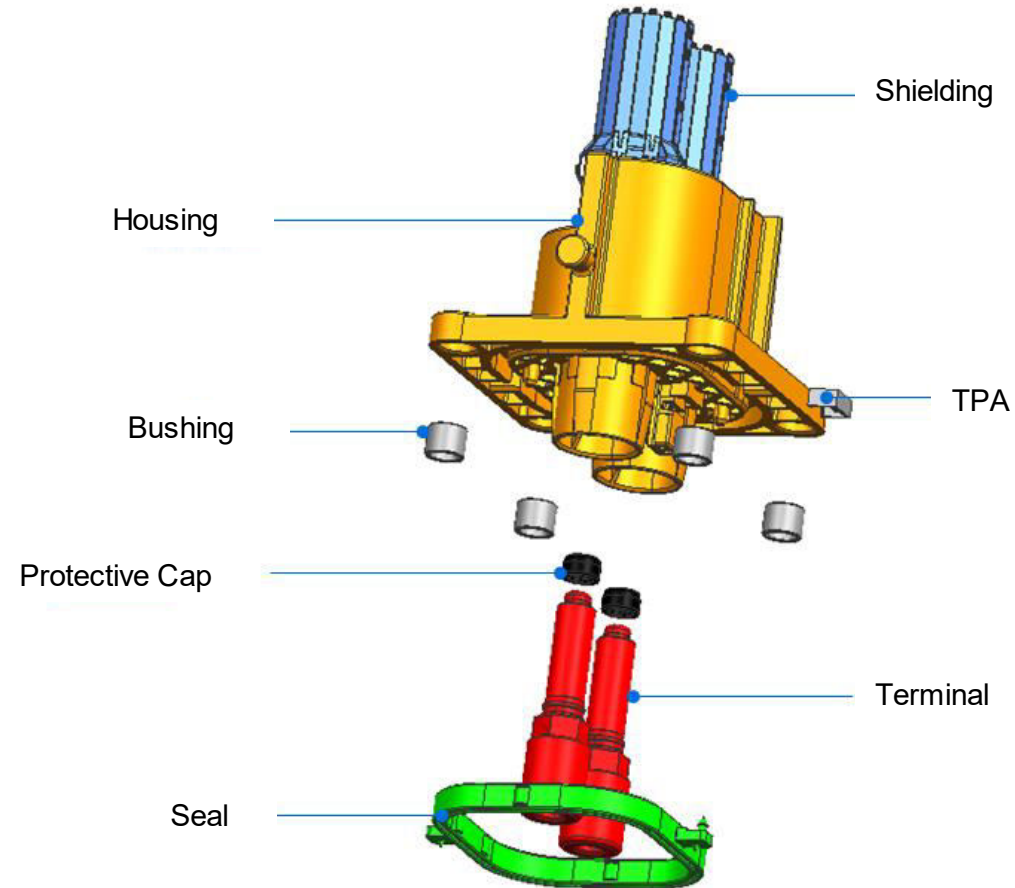
AK  
Class 1

AK  
Class 4

AK  
Pass-throughs

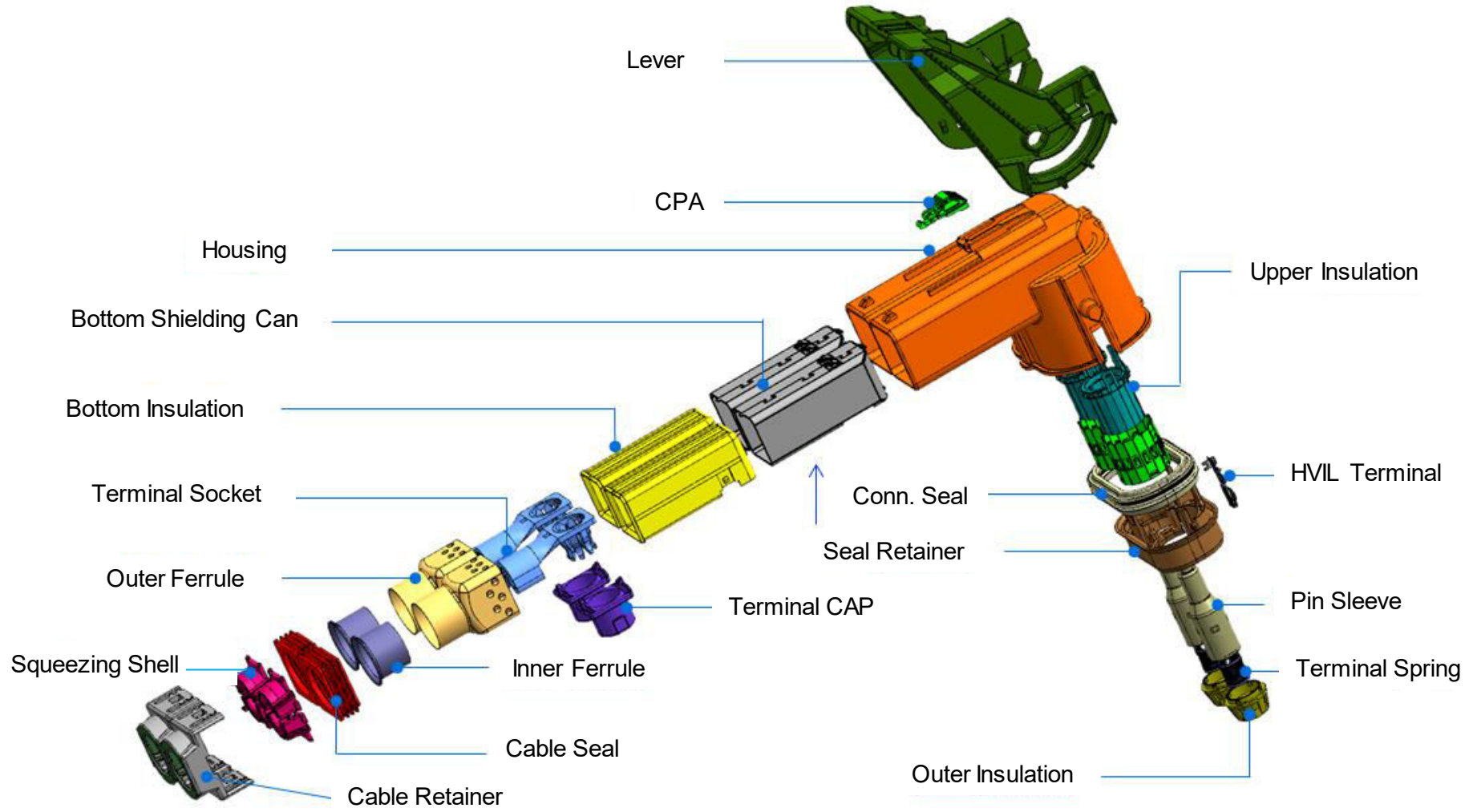
# AK Class 4 exploded view

## Male Header

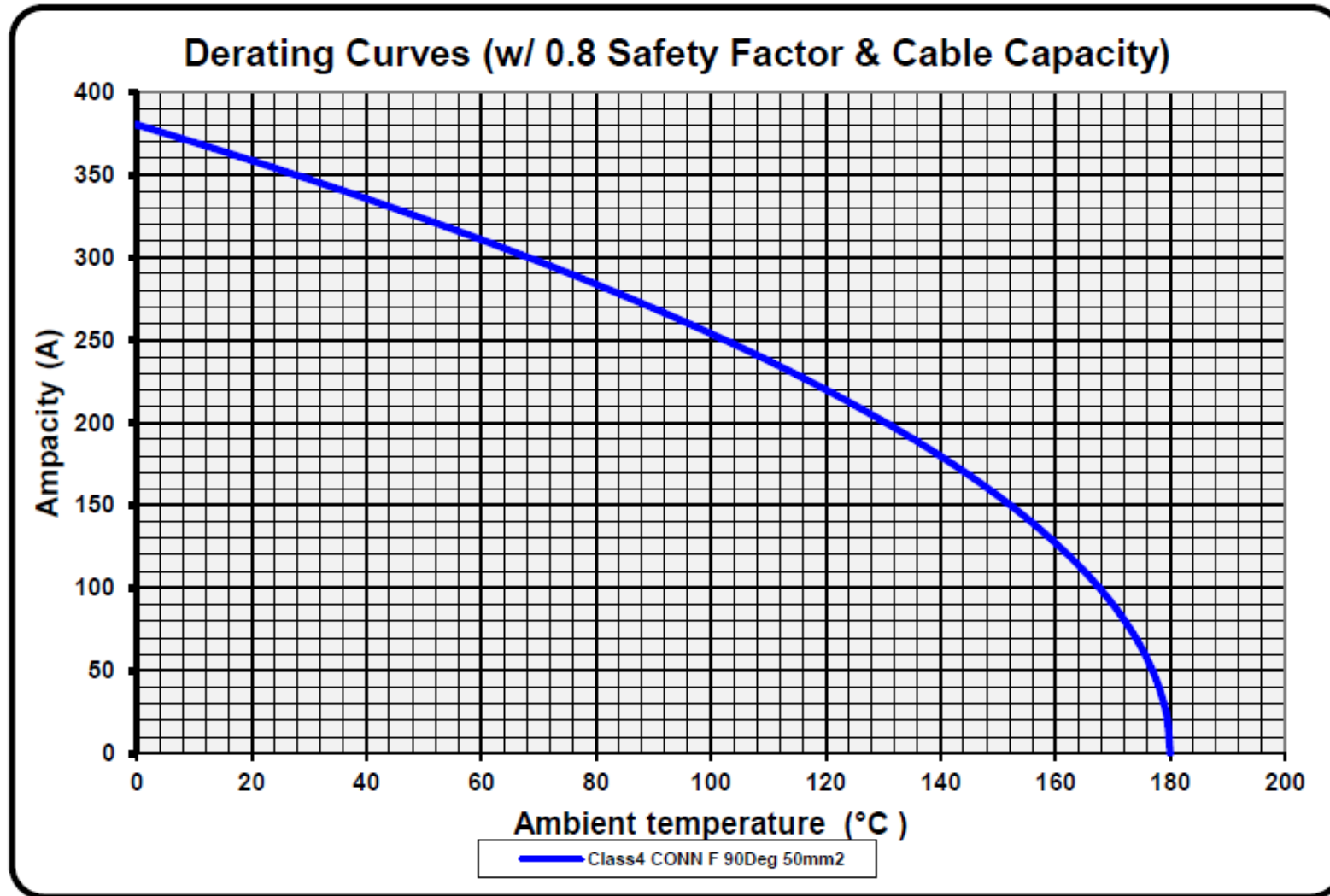


# AK Class 4 exploded view

Female connector 90° cable exit



# AK Class 4 derating Curve





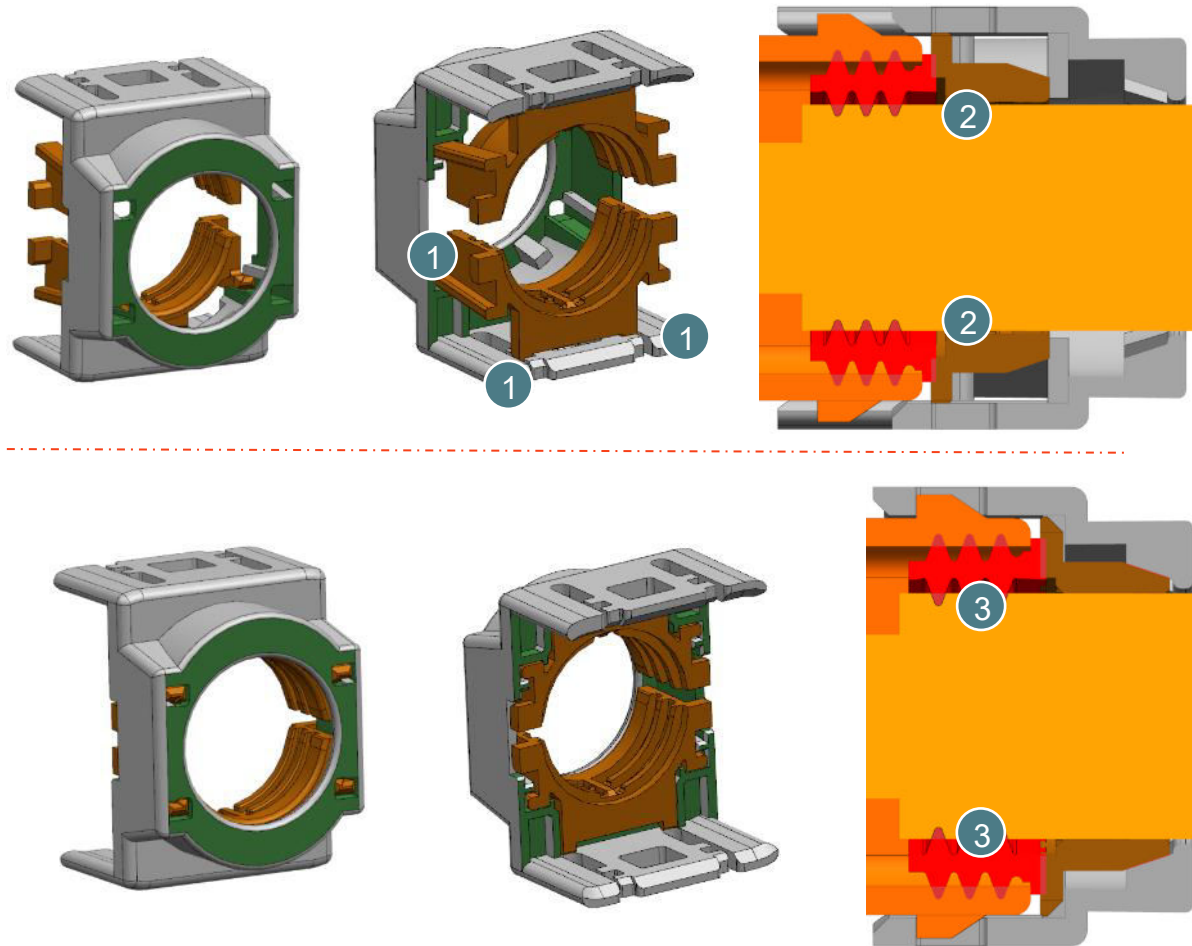
# AK Class 4 technology

## Cable Strain Relief innovations

### Benefits

- Higher product robustness against vibrations

- 1 Lock for Pre-position
- 2 Keep gap on pre-position
- 3 Squeeze cable on final position



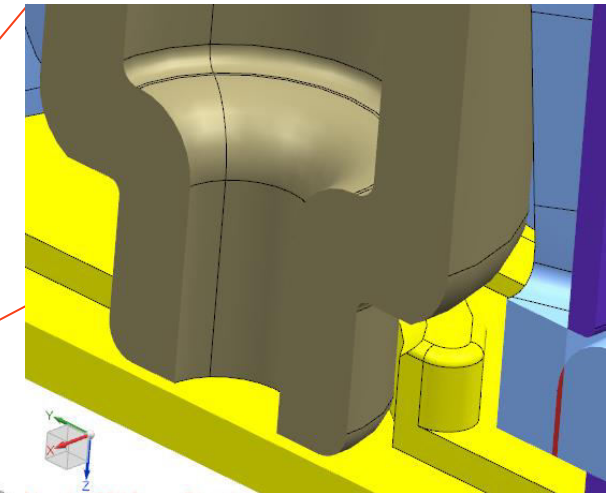
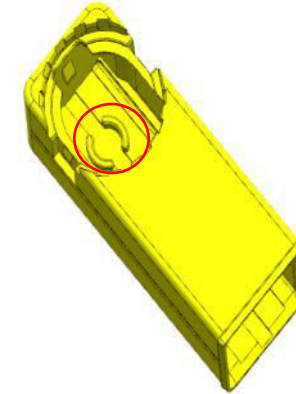
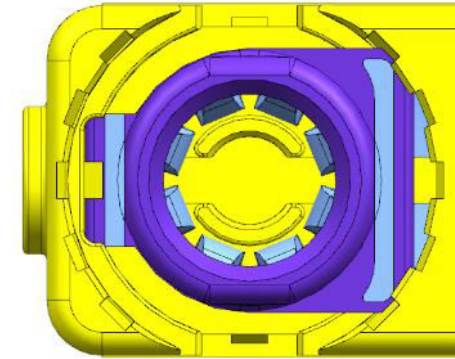
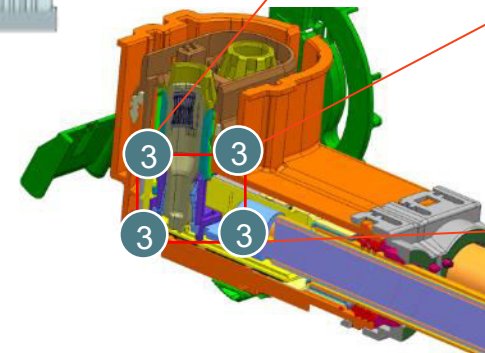
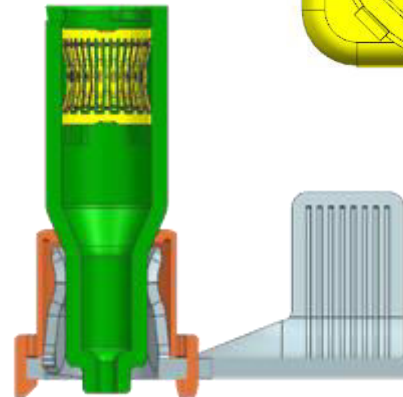
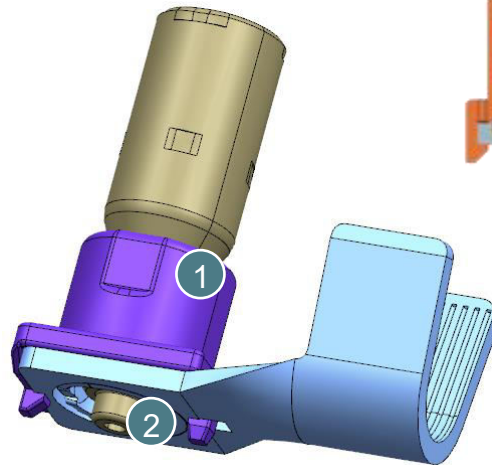
# AK Class 4 technology

## Terminal positioning innovations

### Benefits

- Higher product robustness against vibrations

- 1 **Terminal CAP**
- 2 **Terminal can be waggled along X,Y axis without fixed structure**
- 3 **Add the structure to fix the terminal after inserting.**



# AK Class 4 part numbers

## 2 way Header Connector

| AK Class 4 Header Connector   | Description                       | Part Number | BOM |
|---|-----------------------------------|-------------|-----|
|  | AK4 2 Way Pin Header-Code A UL HB | 35166503    | 1   |
|   | AK4 2 Way Pin Header-Code B UL HB | 35166504    | 1   |
|   | AK4 2 Way Pin Header-Code C UL HB | 35166505    | 1   |
|   | AK4 2 Way Pin Header-Code D UL HB | 35166506    | 1   |
|   | AK4 2 Way Pin Header-Code A UL V0 | 33351454    | 1   |
|   | AK4 2 Way Pin Header-Code B UL V0 | 33351455    | 1   |
|   | MCON 1.2 Male terminal            | 14187603    | 2   |

# AK Class 4 part numbers

## 2 way Female Connector

| AK Class 4<br>Female Connector   | Description                                 | Part Number | BOM |
|--|---|-------------|-----|
|  | AK Class 4 female Code A                    | 33355781    | 1   |
|  | AK Class 4 female Code B                    | 33355782    | 1   |
|  | AK Class 4 female Code C                    | 33355783    | 1   |
|  | AK Class 4 female Code D                    | 33355784    | 1   |
|  | Outer insulation                            | 35172730    | 2   |
|  | Active Female Terminal                      | 35172744    | 2   |
|  | Crimp Female Terminal 25mm                  | 35172741    | 2   |
|  | Inner Ferrule 25mm <sup>2</sup>             | 35172724    | 2   |
|  | Outer Ferrule 25mm <sup>2</sup> - Ni plated | 35172727    | 2   |
|  | ASM Strain Relief 25 mm <sup>2</sup>        | 35172735    | 2   |
|  | Cable Seal 25mm <sup>2</sup>                | 35172732    | 2   |
|  | Crimp Female Terminal 35/50mm <sup>2</sup>  | 35172742    | 2   |
|  | Inner Ferrule 35mm <sup>2</sup>             | 35172725    | 2   |
|  | Outer Ferrule 35mm <sup>2</sup> , Ni plated | 35172728    | 2   |
|  | ASM Strain Relief 35 mm <sup>2</sup>        | 35172736    | 2   |
|  | Cable Seal 35mm <sup>2</sup>                | 35172733    | 2   |
|  | Crimp Female Terminal 35/50mm <sup>2</sup>  | 35172742    | 2   |
|  | Inner Ferrule for 50mm <sup>2</sup>         | 35172726    | 2   |
|  | Outer Ferrule 50mm <sup>2</sup> , Ni plated | 35172729    | 2   |
|  | ASM Strain Relief 50 mm <sup>2</sup>        | 35172737    | 2   |
| Cable Seal 50mm <sup>2</sup>   | 35172734                                    | 2           |     |

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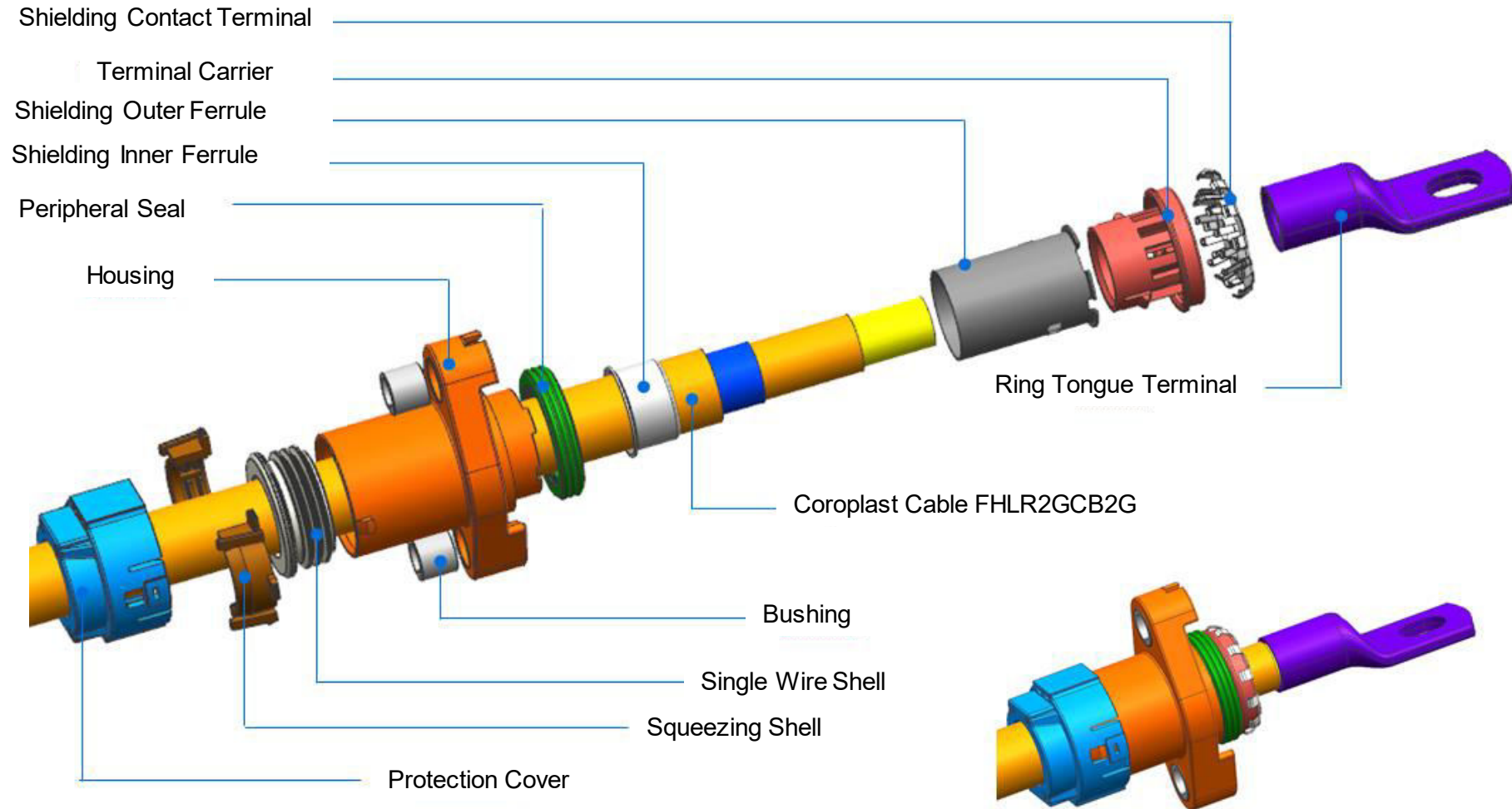
## Technical Overview & Part Numbers

AK Class 1

AK Class 4

AK Pass-throughs

# AK pass-through exploded view



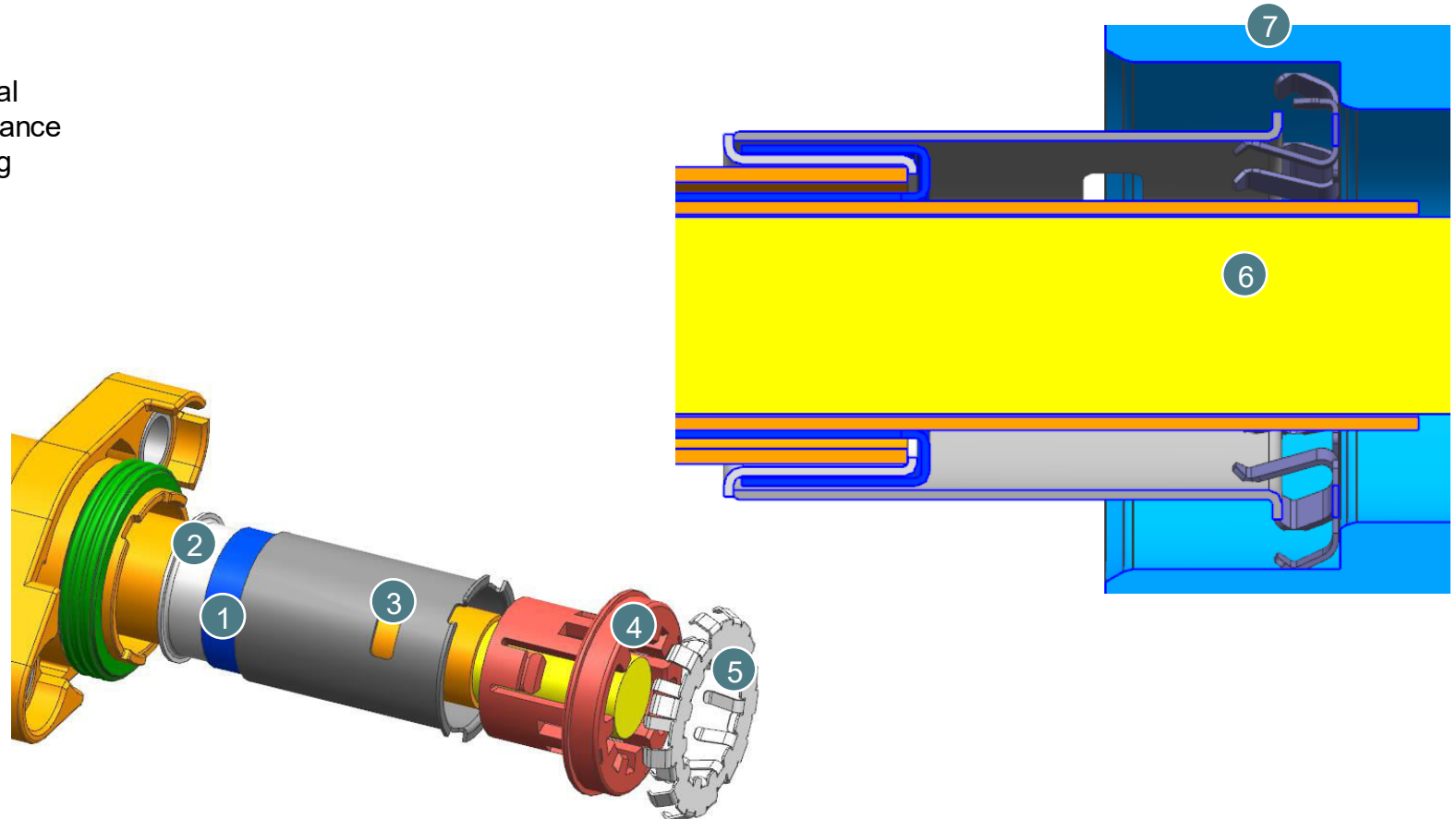
# AK pass-through technology

## Ferrule innovations

### Benefits

- Aptiv Patented 360° shielding contact terminal
  - Ensure high level of shielding performance
  - Ease the shielding process and routing

- 1 Cable shielding
- 2 Shielding Inner Ferrule
- 3 Outer Ferrule
- 4 Terminal Carrier
- 5 Shielding contact terminal
- 6 12 Contact points with inner ferrule
- 7 12 Contact points with metal device

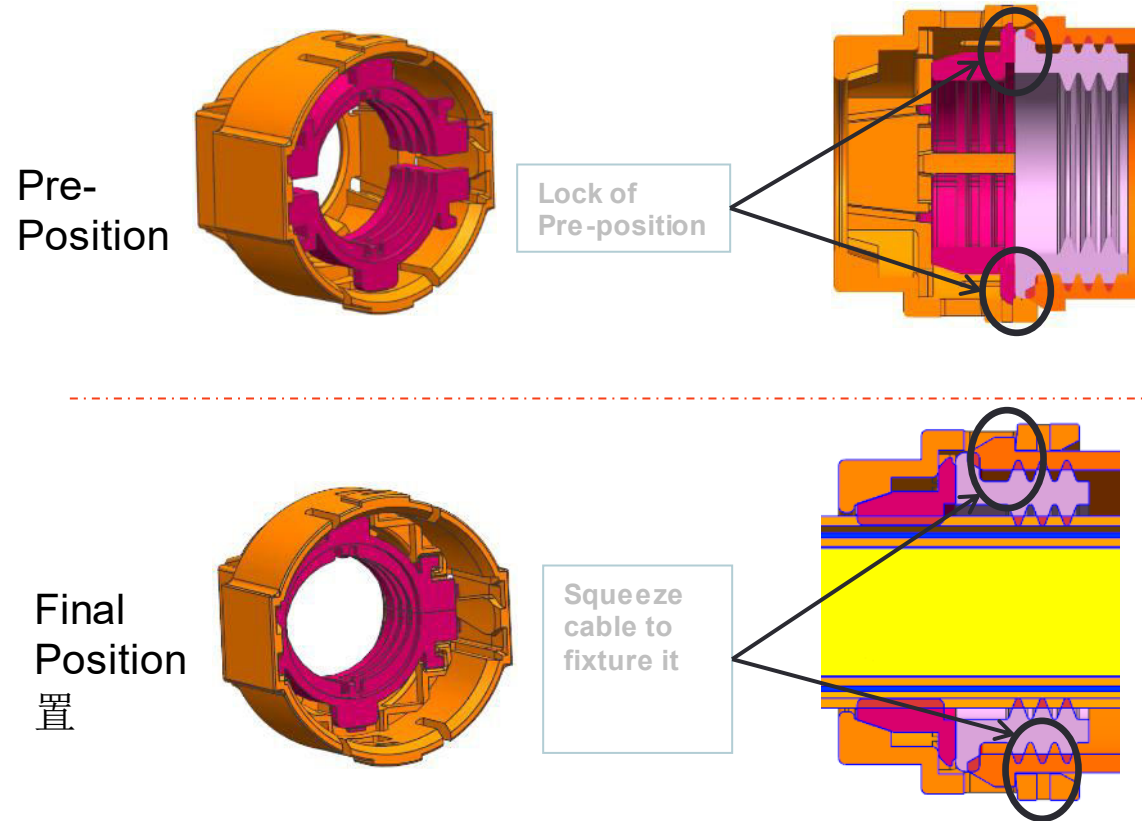
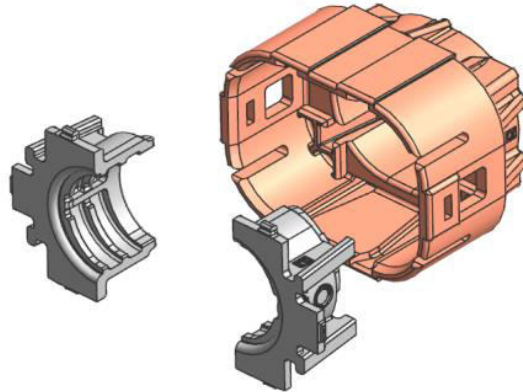


# AK pass-through technology

## Cable strain relief innovations

### Benefits


- Aptiv Patented cable squeezer :
  - increases the reliability of the cable sealing
  - provides more robust anti-vibration performance






# AK Pass-through part numbers

1 way

| AK pass-through<br>1 way   | Description  | Part Number | BOM |
|--|--|-------------|-----|
|  | ASMAK pass-through 1-way Code A                        | 33340524    | 1   |
|  | ASM AK pass-through 1-way Code B                       | 35066699    | 1   |
|  | Peripheral Seal  | 35116341    | 1   |
|  | ASM Shielding Inner Ferrule                            | 35172747    | 1   |
|  | Single Wire Seal for 16 mm <sup>2</sup> cable          | 33340537    | 1   |
|  | Protection Cover Assembly for 16mm <sup>2</sup>        | 33340542    | 1   |
|  | Shielding Outer Ferrule for 16 mm <sup>2</sup> cable   | 33340554    | 1   |
|  | Single Wire Seal for 25 mm <sup>2</sup> cable          | 35172739    | 1   |
|  | Protection Cover Assembly for 25 mm <sup>2</sup> cable | 33340541    | 1   |
|  | Shielding Outer Ferrule for 25 mm <sup>2</sup> cable   | 35172745    | 1   |
|  | Single Wire Seal for 35 mm <sup>2</sup> cable,         | 35172738    | 1   |
|  | Protection Cover Assembly for 35 mm <sup>2</sup> cable | 33340540    | 1   |
|  | Shielding Outer Ferrule for 35 mm <sup>2</sup> cable   | 35172743    | 1   |
|  | Single Wire Seal for 50 mm <sup>2</sup> cable,         | 33340534    | 1   |
|  | Protection Cover Assembly for 50 mm <sup>2</sup> cable | 33340539    | 1   |
| Shielding Outer Ferrule for 50 mm <sup>2</sup> cable                               | 33340551   | 1           |     |


# AK Pass-through part numbers

2 way

| AK pass-through<br>2 way  | Description  | Part Number | BOM |
|---|--|-------------|-----|
|  | ASMAK pass-through 2-way                               | 33340525    | 1   |
|   | Peripheral Seal  | 35116341    | 2   |
|   | ASM Shielding Inner Ferrule                            | 35172747    | 2   |
|   | Single Wire Seal for 16 mm <sup>2</sup> cable          | 33340537    | 2   |
|   | Protection Cover Assembly for 16mm <sup>2</sup>        | 33340542    | 2   |
|   | Shielding Outer Ferrule for 16 mm <sup>2</sup> cable   | 33340554    | 2   |
|   | Single Wire Seal for 25 mm <sup>2</sup> cable          | 35172739    | 2   |
|   | Protection Cover Assembly for 25 mm <sup>2</sup> cable | 33340541    | 2   |
|   | Shielding Outer Ferrule for 25 mm <sup>2</sup> cable   | 35172745    | 2   |
|   | Single Wire Seal for 35 mm <sup>2</sup> cable,         | 35172738    | 2   |
|   | Protection Cover Assembly for 35 mm <sup>2</sup> cable | 33340540    | 2   |
|   | Shielding Outer Ferrule for 35 mm <sup>2</sup> cable   | 35172743    | 2   |
|   | Single Wire Seal for 50 mm <sup>2</sup> cable,         | 33340534    | 2   |
|   | Protection Cover Assembly for 50 mm <sup>2</sup> cable | 33340539    | 2   |
|   | Shielding Outer Ferrule for 50 mm <sup>2</sup> cable   | 33340551    | 2   |

# AK Pass-through part numbers

3 way

| AK pass-through<br>3 way   | Description  | Part Number | BOM |
|--|--|-------------|-----|
|  | ASMAK pass-through 3-way                               | 33340526    | 1   |
|  | Peripheral Seal  | 35116341    | 3   |
|  | ASM Shielding Inner Ferrule                            | 35172747    | 3   |
|  | Single Wire Seal for 16 mm <sup>2</sup> cable          | 33340537    | 3   |
|  | Protection Cover Assembly for 16mm <sup>2</sup>        | 33340542    | 3   |
|  | Shielding Outer Ferrule for 16 mm <sup>2</sup> cable   | 33340554    | 3   |
|  | Single Wire Seal for 25 mm <sup>2</sup> cable          | 35172739    | 3   |
|  | Protection Cover Assembly for 25 mm <sup>2</sup> cable | 33340541    | 3   |
|  | Shielding Outer Ferrule for 25 mm <sup>2</sup> cable   | 35172745    | 3   |
|  | Single Wire Seal for 35 mm <sup>2</sup> cable,         | 35172738    | 3   |
|  | Protection Cover Assembly for 35 mm <sup>2</sup> cable | 33340540    | 3   |
|  | Shielding Outer Ferrule for 35 mm <sup>2</sup> cable   | 35172743    | 3   |
|  | Single Wire Seal for 50 mm <sup>2</sup> cable,         | 33340534    | 3   |
|  | Protection Cover Assembly for 50 mm <sup>2</sup> cable | 33340539    | 3   |
|  | Shielding Outer Ferrule for 50 mm <sup>2</sup> cable   | 33340551    | 3   |

# Thank you.