



## 36V Battery Terminals

Research and Technology

### Comparison of the proposals made by

*AMP*

*Amphenol*

*Cannon*

*Delphi*

*Yazaki*

**at the 36V Battery Terminal Workshop**

**on April 14, 2000 in Detroit**



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### DaimlerChrysler requirements

- Peak current capability (two values for different cranking methods in different vehicles):
  - Extreme 15kW at 25V: 600A for 5s
  - Normal 8kW at 25V: 320A for 5s
- Max. resistance 0,5 mOhm
- Ambient temperature -35°C ... +60°C (+80°C for 3h)
- Terminals should be inaccessible when connection is mated
- Crocodile connectors should not fit to 36V battery contacts
- Battery connections should be mated or unmated without tools
- Minimum 20, better 50 times mating / unmating over life
- Connectivity: ideal would be the possibility of connecting cables or connectors in longitudinal or lateral direction of the battery as well as direct connection to an electronics box. The most flexible solution is best in this respect.



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## Functional comparison

| Function<br>(colour: importance) | explanation of values  | AMP  | Amphenol #1 | Amphenol #2 | Amphenol #3 | Cannon | Cannon dual | Delphi | Yazaki | comment  |
|----------------------------------|--|------|-------------|-------------|-------------|--------|-------------|--------|--------|--|
| max. contin. current             |  | 150A |             |             |             | 240A   | 140A        | 150A   |        |  |
| el. resistance                   | flat ++<br>round, local contacts +<br>round, full contact ++ | ++   | +           | +           | +           | +      | +           | ++     | ++     | given the same cross section, flat contacts have more than 1,5 times larger contact area than round ones |
| protection level open            | crocodile safe ++  | ++   | ++          | ++          | ++          | ++     | ++          | ++     | 0      |  |
| protection level connected       | completely covered ++  | ++   | ++          | ++          | ++          | ++     | ++          | ++     | +      |  |
| cost                             | relative cost  | 0    | 0           | -           | -           | -      | -           | 0      | +      | ???  |
| connectivity                     | as today ++<br>restricted directions +                       | +    | ++          | ++          | ++          | ++     | ++          | +      | ++     | do we need full freedom in turning cables? Or could this be designed into the connector ?                |
| need of tools                    | no tools ++  | ++   | ++          | ++          | ++          | ++     | ++          | ++     | 0      |  |
| mating stability                 |  | ++   | ++          | ++          | ++          | ++     | ++          | ++     | +      | threads may wear out   |
| indexing                         | several possibilities ++<br>polarity +                       | ++   | ++          | ++          | ++          | ++     | ++          | ++     | +      |  |
| environmental                    | sealability ++   | +    | ++          | ++          | ++          | ++     | ++          | ++     | 0      |  |
| serviceability                   |  | +    | +           | +           | +           | +      | +           | +      | +      |  |



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### Conclusions

- Yazaki's solution is less safe than the other solutions (alligator clamps are attachable at open battery - risk of wrong connections!)
- The other solutions are roughly equivalent in function
- Flat blades are better for lower resistance at a given amount of material - round blades are better for heat dissipation at a given contact resistance (what is closer to the limit?)
- Flat blades are better to distinguish from 12V batteries
- Electrochemical / thermal stability of hard metal parts in lead ?
- Cost of the different solutions is crucial - quantitative values needed!
- Especially: What is the cost difference from Yazakis solution compared to the AMP or Delphi solution ?