

# Hot Conductors and Black Conductors

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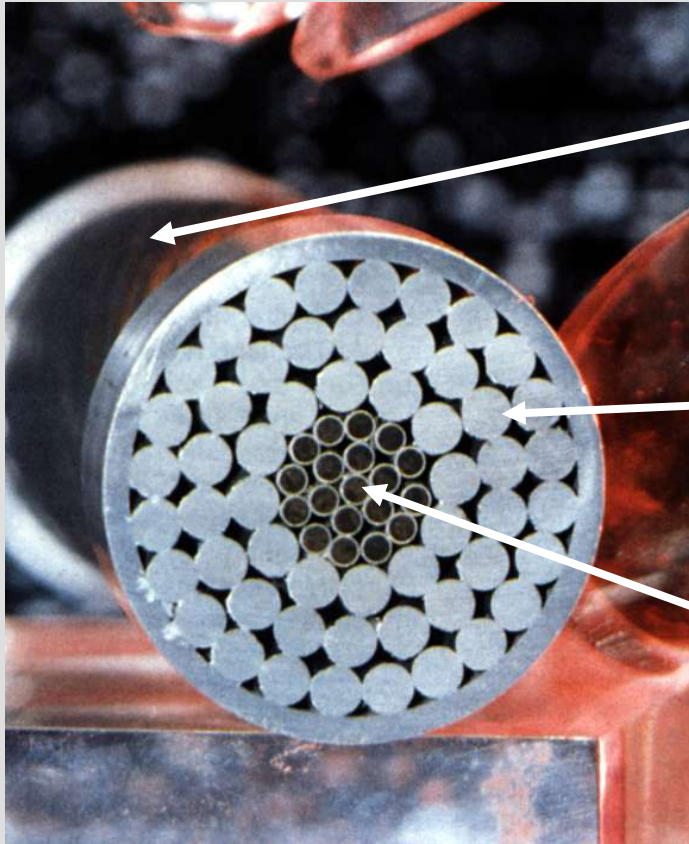
# Hot Conductors

**Hot conductors (TAL/ACS-conductors) are composed of mono-metallic TAL-wires and composite conductors (ACS-wires)**

**Most essential benefit of these conductors is the higher current carrying capacity compared with standard ACSR-conductors**

**Up to 50% higher current carrying capacity is possible**

# Hot Conductors



Surface:  
shiny

Outer Layer:  
TAL-wires

Core:  
ACS-wires

**TAL / ACS-conductor**

# Black Conductors

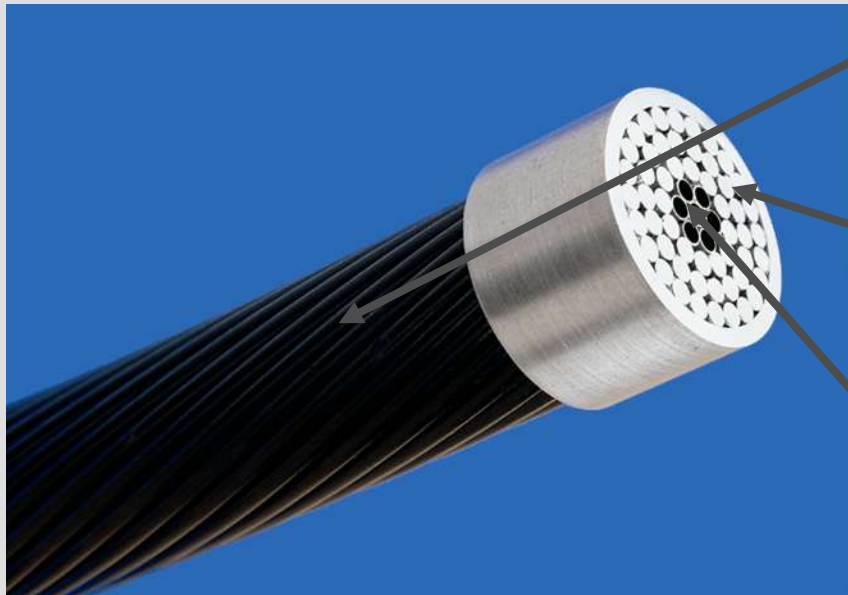


**Black conductors are a further development of the hot conductors, they are blackened with a permanent layer of colour on their surface (BTAL/ACS-conductors)**

**A higher heat radiation means that the current carrying capacity can be increased compared with the hot conductors at the same temperature.**

**More than 50% higher current carrying capacity is possible**

# Black Conductors



**BTAL / ACS-conductor**

Surface:  
black coated

Outer Layer:  
TAL-wires

Core:  
ACS-wires

# What is TAL?

**TAL (= thermal resistant aluminium) is an alloy of aluminium.**

**Starting from high grade aluminium (99,7/ purity) an alloy containing, among other elements, small amounts of zirconium**

Zirconium retains its mechanical properties even after operation at higher temperatures up to 150°C over long periods

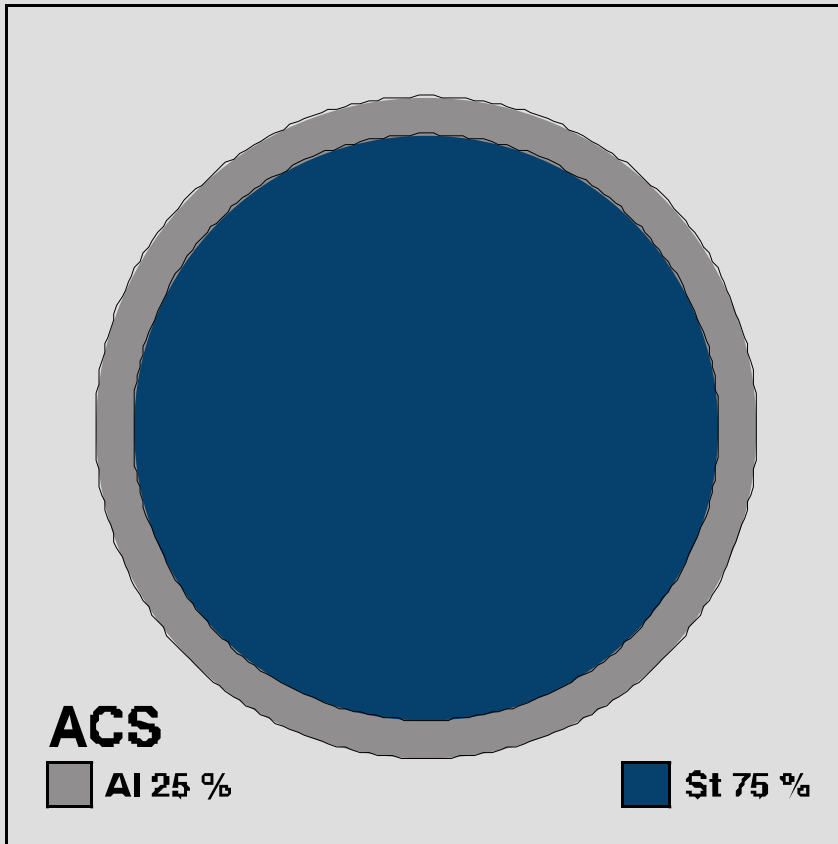
**Standard aluminium can be used only for temperatures up to 80°C**

**With the exception of the higher thermal rating and the conductivity all other properties/qualities are completely identical**

# Comparison of different material characteristics

	Conduc- tivity	Tensile strength	Modulus of elasticity	Coeff. of linear expansion	max.	working	temp.
					cont. working	short time <30 Min.	short circuit
UNIT	% IACS S m/mm <sup>2</sup>	daN/ mm <sup>2</sup>	daN/ mm <sup>2</sup>	1/ °C	°C	°C	°C
<b>TAL</b>	<b>60</b>	<b>16 - 19</b>	<b>6000</b>	<b>2,3 x10-5</b>	<b>150</b>	<b>180</b>	<b>260</b>
	<b>34,8</b>						
E-AL	61	16 - 19	6000	2,3 x10-5	80	(80)	160
	35,38						

# What is ACS?

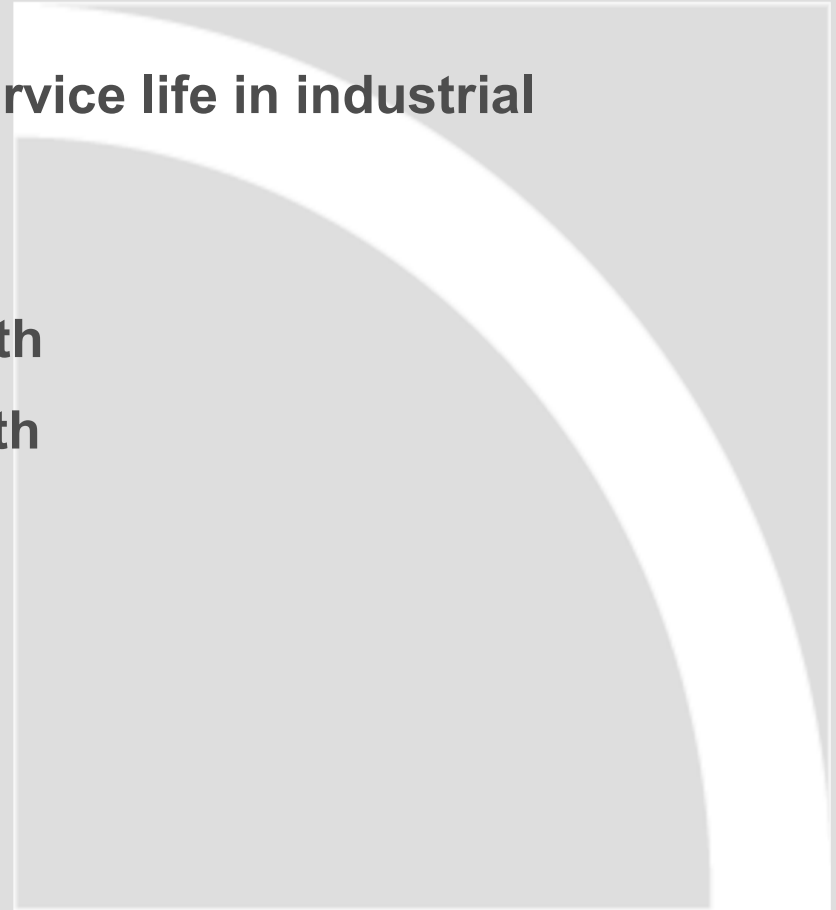


ACS  
(= aluminium clad steel)  
is a high strength steel  
wire with a thick  
aluminium coating

# Advantages of ACS

## Advantages of ACS

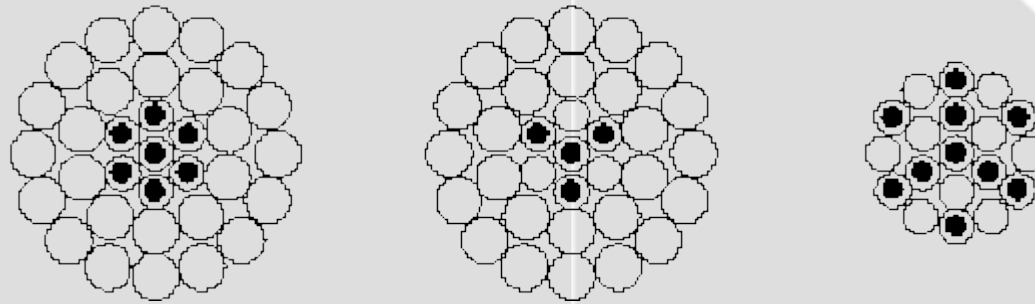
- Corrosion resistance and long service life in industrial atmospheres
- Higher short current capacity
- Higher mechanical tensile strength
- Higher continuous tensile strength
- Higher conductivity
- Reduction of performance losses
- Less weight
- Less sag
- Less tower load at the same sag



# Mixed configuration in composite conductors with TAL/ACS

**The use of ACS-wires allows a mixed configuration in composite conductors**

**Examples of the construction of the TAL/ACS-conductors:**



**Thus a far reaching project-oriented optimization of the conductor for mechanical and electrical conditions is possible**

# Typical Applications and Economic Benefits

## Typical applications for the use of TAL/ACS-conductors - economic benefits

- Refitting of older transmission lines for a higher current carrying capacity
- Elimination of critical bottleneck standard conductors in overhead lines instead of a replacement with larger standard conductors or higher voltage level
- Increase of the current carrying capacity in a changing market
- Redundant (n-1)-application or to cover power peaks

# Economic Analysis

**An economic analysis should contain the following points:**

- The costs for a new line with a larger conductor diameter**
- A higher price for TAL and for a black coating**
- Due to the increased sags, maybe a heightening of the towers is necessary**
- Costs for an increase of the losses**

# Additional Benefits of Black Conductors

## Additional benefits of a conductor coating with black colour

- Immediate capacity with nominal current under all weather conditions
- Reduction of the transmission losses
- Reduction of necessary tower reorganizations
- Less corona losses and decreasing of the corona noise
- Highest corrosion protection
- Higher current carrying capacity



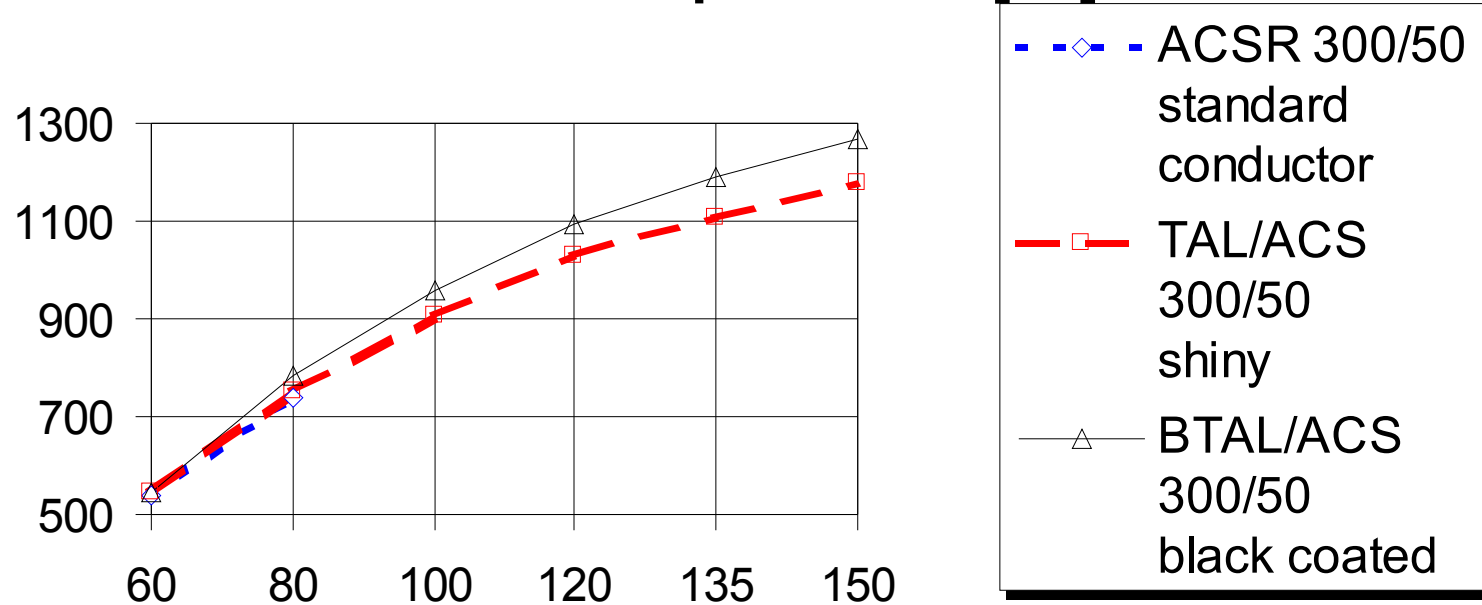
# Specification of the Coating

## **Specification of the coating process and the material**

- Temperature- and UV-resistance of the coating material**
- As-thin-as-possible coating with a low isolation effect**
- Maximum adherence of the material and easy to remove in the fitting area**
- Elastic and robust coating**
- Metallic contact between each layer of the conductor**

# Nominal Current at Different Conductor Temperatures

**Nominal current [A] at different  
conductor temperatures [°C]**



# Nominal Current at Different Conductor Temperatures

Nominal current at different conductor temperatures

conductor temp. [°C]	60	80	100	120	135	150
<b>ACSR 300/50 standard conductor</b>	540	740				
<b>TAL/ACS 300/50 shiny</b>	546	754	905	1026	1105	1175
<b>BTAL/ACS 300/50 black coated</b>	547	785	957	1096	1188	1270

 = max. values

# Temperature of Fittings with a 150°C Hot Conductor

	temperature in °C
<b>conductor TAL/ACS 380/ 50</b>	<b>150</b>
<b>tension clamp</b>	<b>71</b>
<b>full tension compression joint</b>	<b>107</b>
<b>suspension clamp</b>	<b>94</b>
<b>current carrying clamp</b>	<b>93</b>

In addition to the coating of the overhead conductors, also every kind of fittings could be blackened to use the effect of temperature radiation.



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