

2006 Wire Workshop

2G Wire Requirements - Cables



Southwire
WE DELIVER POWER

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UlteraTM

A Southwire / nkt cables Joint Venture

nkt cables

Wire Requirements

1. Mechanical / Physical
2. Electrical
3. Thermal
4. Connectivity
5. Financial

1. Mechanical / Physical

- Width \Rightarrow variable, 3.8 to 4.4 mm
- Long Continuous lengths \Rightarrow 500+ meters
 - Low resistance factory splices is a MUST
- Corrosion Resistance in high humidity
 - Cable plants are not 'clean rooms' like HTS wire plants
- Wires must withstand 2 demanding mechanical processes:
 - Stranding
 - Installation

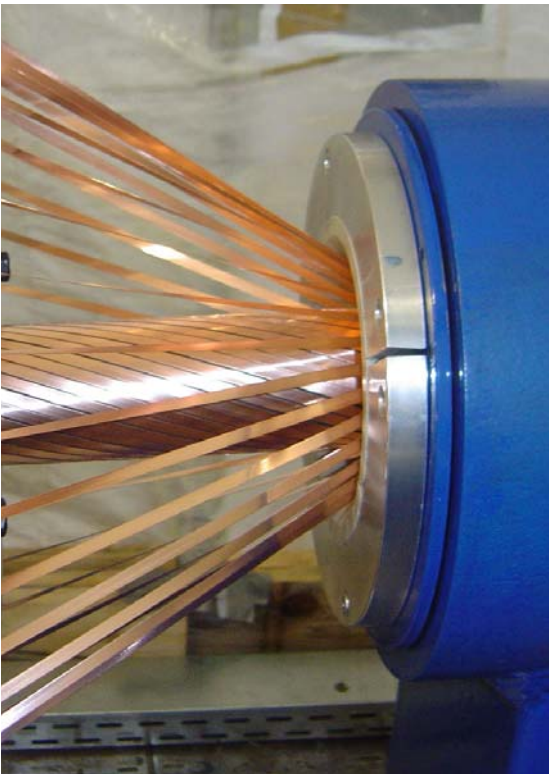
As minimum \Rightarrow mechanical properties must be equal to 1G wires.

Stranding

Min Bending Radius

Longitudinal Stress & Strain

Twisting



Installation



Cryostat Pulling

Cable Pulling

Installation

Longitudinal Stress \Rightarrow cable pulling

C-axis compressive stress

- Side-wall bearing pressure \Rightarrow Compressive stress against the side of cable from pulling through a bend in duct bank.

2. Electrical Properties

- $I_c \Rightarrow 100 - 180$ Amps (per 4mm width)
- AC-Loss \Rightarrow As low as possible!
 - AC loss directly impacts cooling system size and ongoing operational costs.
 - Economically viable cable systems must reduce cryo load as much as possible.

3. Thermal

- Fault Current stabilization
 - Cu stabilizer ‘built’ into wire
 - Reduces chance for damage to HTS wires during fault
- Higher T_c
 - Higher critical temperature can:
 1. Provide increased operating margin for cryo system
 2. Operate at higher temperature to reduce cooling costs

4. Connectivity

Low Resistance, Easy & Quick to Assemble Joints \Rightarrow No complicated procedures due to non-conductive buffer layers or substrates.

- Tape – to – Tape splices
 - Change out wire spools during manufacturing of long lengths
 - Repairing wire breaks during stranding process
- Tape – to – Copper joints
 - Join cable to termination

5. Financial

* MUST BE LOW COST

- Need to reach 50 \$/kA-m in next 2-3 years.
- Need to achieve 10 \$/kA-m in next 5-8 years.
- This is critical time for HTS power applications – must capitalize on successful projects
- Market can not bear 150-200 \$/kA-m wire.
- If prices do not come down, HTS cable will never be more than niche product for very specialized applications.