TUSKER TERMINAL – A PRACTICAL SOLUTION FOR

ELECTRO-FEVER, an OVER-HEATING Issue in Electrical Systems

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INTRODUCTION

This paper contains information about ELCTRO-FEVER occurring in electrical connections of existing Electrical Equipment; here we specifically refer to POWER & DISTRIBUTION TRANSFORMER, ISOLATOR, CTs, AB Switches etc

As any other fever, ELECTRO-FEVER is nothing but overheating associated with all connections which gradually increase with increase in electrical resistances and contributes in degradation of equipment, cables & whole electrical system efficiency

ELECTRO-FEVER Overheating or Hotspots

Undesirable Temperature rise @Connections are due to high contact resistance of conventional bolted and crimped connections and dissimilar Contact Surfaces. Limitations associated with these connectors include frequent overheating of connectors that leads to failures and interruptions resulting in power loss and revenue losses.

Water and Dust Ingress, Pollution, Increasing Ambient temperatures including heat fluctuations, Corrosion will further deteriorate contacts to increase contact resistance drastically.

ROOT CAUSES

Electrical Contact Resistance is important parameter to assess connector quality and reliability. Three main factors which affect contact resistance values are Conduction, Oxidation factor and Pressure/Force applied while connection.

Following factors are essentially contributing towards high Contact Resistances and added to undesirable Temperature Rise

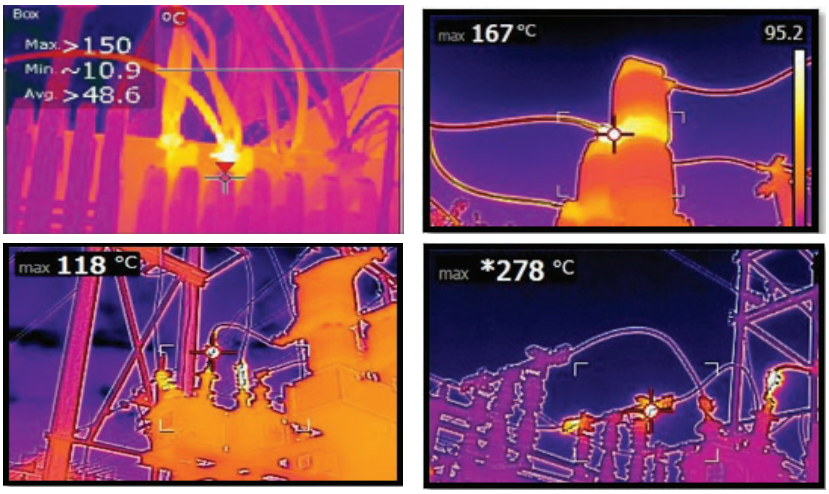
A. Raw Materials

B. Connector Designs

C. Manufacturing Methods

- Sand or Gravity Die Casting: Partial Porosity, Al Alloy & Process Limitations
- Extrusions:No Porosity and High Conductive Aluminum Alloys
- Conventional Machining: Not suitable for mass production and quality products
- CNC Machining: Reliability and Repeatability

Efficiency Degradation of Electrical Equipments due to **Over-Heated** Electrical Connections.



Thermo-vision Photos: Transformer, Isolators and CTs

SAFE & EFFICIENT CONNECTORS' CRITERIA	
Easy to Install (simple tools, less effort)	**Easy to Maintain, Monitor & Control** (O&M Concern)
Proven **Safety** (Fool-proof / Mistake-Proof): ZERO Accidents	Compact & Light Weight (**FOOTPRINTS : Space Constraint** - mainly in Metros)
Wide range acceptability (**Standardization** w.r.to sizes/types)	**Robust** in extreme conditions (Dust, Pollution & Moisture, Heavy Rain.)
Economical - Value for Money (Justifiable – Value Proposition)	**Reliability** (Product Life Cycle) **Retrofit** arrangement (for existing system / products)

of consistent Manufacturing Process

The best combination is to design connectors based on Extrusions and CNC machining

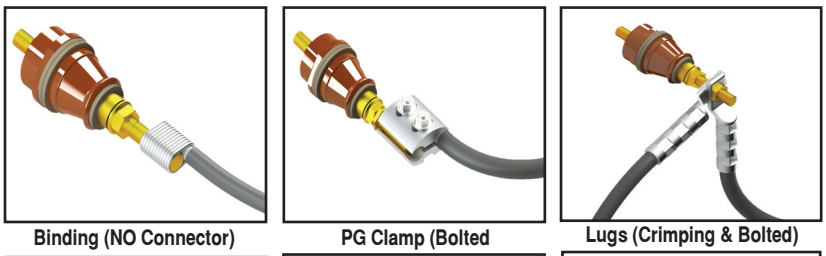
RECOMMENDATIONS

- To reduce overheating, High Ampacity Connectors with TR (< 200C) above ambient (instead of <= 450C) and other stringent changes in specifications are to be done.
- Connectors are our Weakest Link in any electrical systems and can be big opportunity to REDUCE Losses and to INCREASE system reliability. Loss at each connection has potential to save, if energy efficient connectors are deployed and commissioned in mass.
- Along with "Energy Efficient Equipment's& Cables" we need INNOVATIVE "Energy Efficient Connectors" which are clearly more efficient (than defined) & suitable for O&M need till last miles.
- Standardization of Cables and Connectors are key

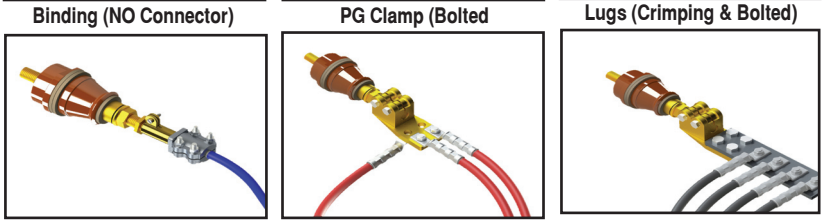
CUSTOMIZATION WORK & CASE STUDY RESULTS FOR NEW CONNECTORS

- We have come up with INNOVATIVE designs which are PATENT applied and these products will act as Power Loss Reducer thus named as TUSKER Terminals which are O&M Friendly & will build Energy Efficient & Reliable system for long term.
- Temperature Rise (above ambient) results are less than 20^{0}C and showing no major changes in resistance values.
- These new connectors are available for Threaded Studs, Plain Dia. Studs, FlatBusbars& IPS Al Tubes.

Existing Connection Methods

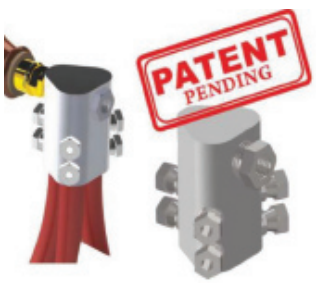


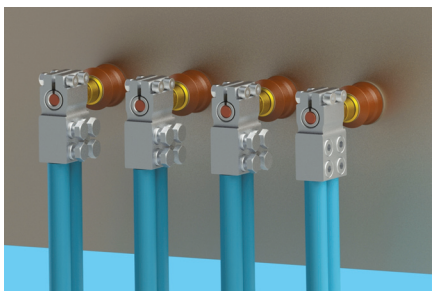
Binding (NO Connector) | PG Clamp (Bolted | Lugs (Crimping & Bolted)



Brass-Aluminium Connector | Palm Connector & Lugs | Palm Conn., Busbar & Lugs

Safe, Reliable, Energy Efficient Solution: TUSKER TERMINALs





CONCLUSION

On real-time testing, we have observed there is great potential of Power savings (minimization of Heat Losses) based on I2R calculation. Contact Resistances have been improved from three digits to single digits and thus reducing TR during life cycle of Equipment's and Cables. OVER-HEATING depends upon Connector selection based on applications, O&M Practices and associated Contact Resistance Values hence to overcome ELECTRO-FEVER, we need ENERGY Efficient Connection Systems "TUSKER Terminals" ■

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(TUSKER Terminals for M12, M20, M30, M40, M48 Studs)