Fuses vs Fuseless Technology

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The Great Debate

- Fuse
- Fuse Switch
- Switch fuse

- ACB
- MCCB
- MCB
- Switch + Relay

The Great Debate

Lets go back to basics……

- **Question: Why do we use protection devices????**
- **Common Ans: To prevent Faults**

Wrong!

Protection whether by fuse, circuit breaker or relay cannot prevent faults from happening. Only good design, high quality components, careful installation, preventative maintenance along with good working practices can prevent major faults

However, protection devices can limit the damage and inconvenience caused if faults occur.

The Great Debate

- What do we mean by a fault?

  Overload

  Operating condition in an electrically undamaged circuit which causes an current to flow in excess of the full load current

  Example: Starting condition during DOL start

If this type of fault continues indefinitely because of an anomolous operating condition., damage begins to occur creating…….

The Great Debate

- What do we mean by a fault?

  Short Circuit

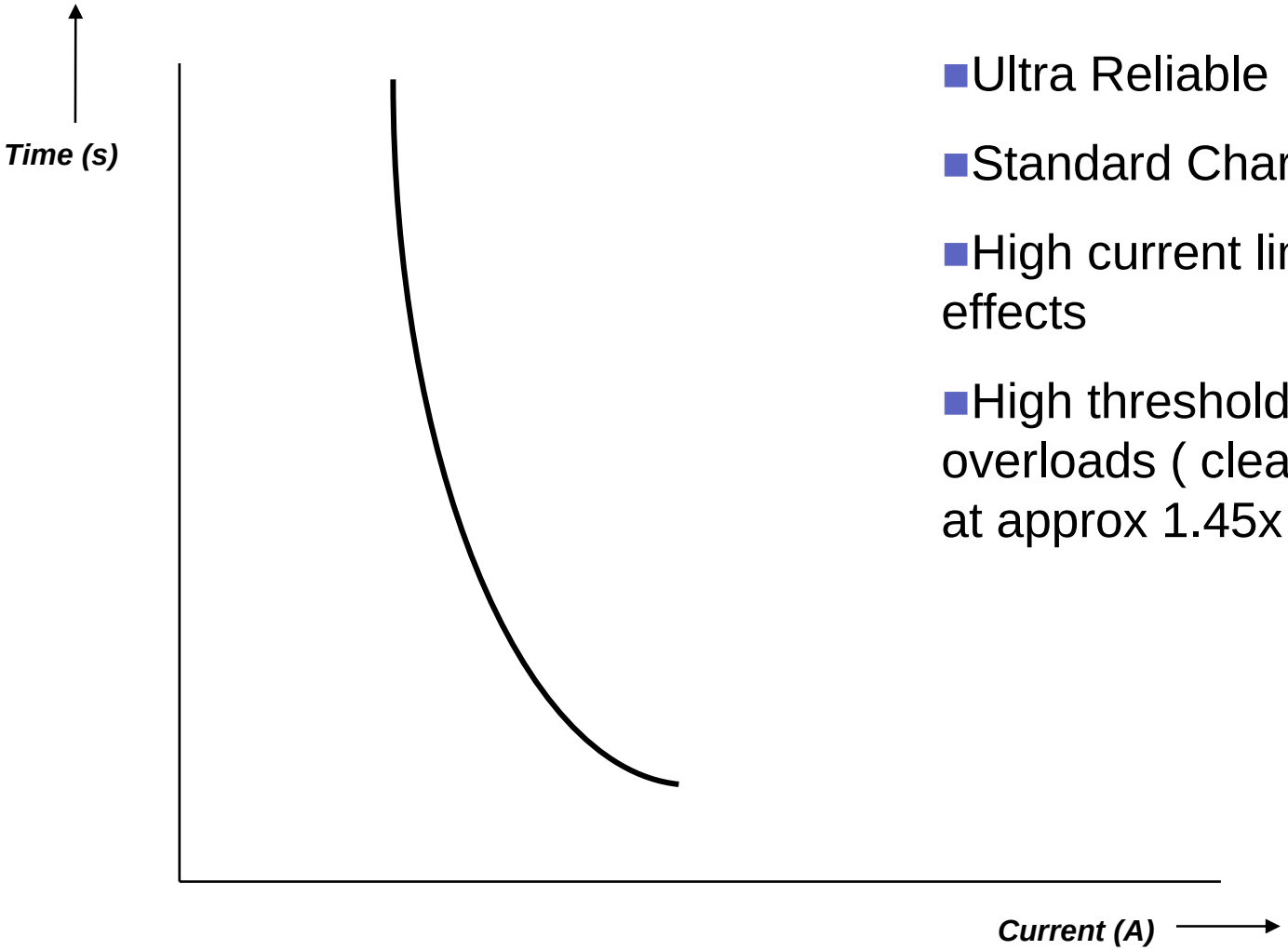
  Operating condition in an electrically damaged circuit where there is an accidental or intentional connection by a relatively low resistance between two points of a circuit which are normally at different voltages

This type of fault can generate high current flows, arcing and fire if not cleared quickly

The Great Debate

- So back to the debate……. Which technology is best?
- The answer is not simply a matter of one being superior to the other
- Lets look at the technology more closely

Typical fuse



- Ultra Reliable
- Standard Characteristic
- High current limitation effects
- High threshold on low overloads (clears overloads at approx 1.45x rated FLC)

Fuses & their associated switches

Advantages

- Lower cost than comparative MCCB up to approx 400A
- Fuses readily interchangeable between switches of different manufacture hence low stocking costs for protective element
- Test Position for auxiliary contact testing
- Easier discrimination/selectivity due to non-adjustment of protective element

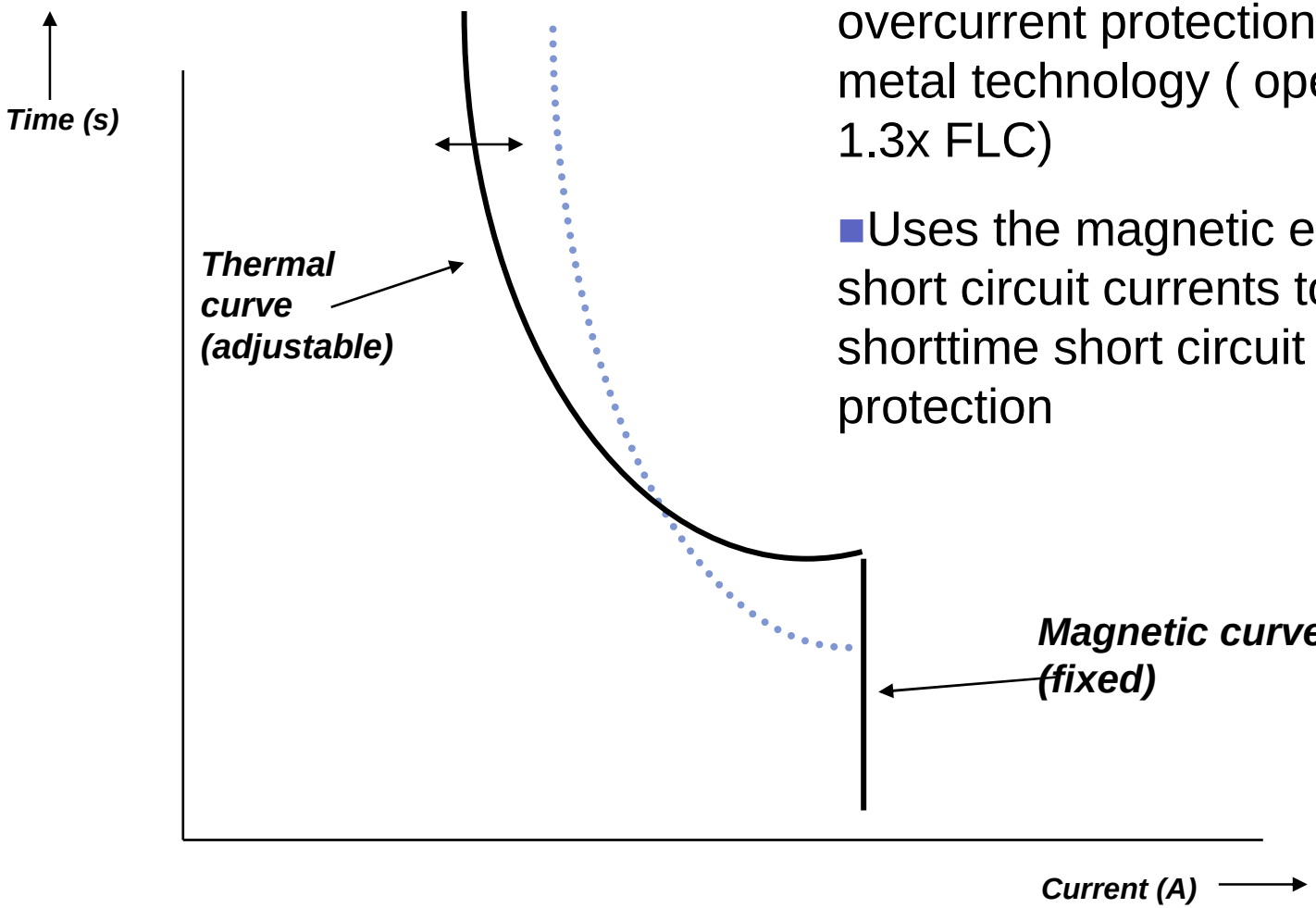
Disadvantages

- Expensive to automate (motorise)
- Limited data extraction (ON/OFF, Fuse intact/Blown)
- Single shot protection before manual intervention
- Deterioration of protection with age and current stress
- System protection can be compromised by use of increased fuse size or by defeating fuse (the old copper wire trick!!)
- Non-adjustment capability leads to potential oversizing of cables to achieve discrimination

Fuseless technology

- Two main types:-
- Thermomagnetic protection- MCB and lower rated MCCB plus older type protection relays
- Electronic protection – Microprocessor based relays fed from CTs either external to switches or integral within a circuit breaker

Thermomagnetic



- Offer thermal longtime overcurrent protection using Bi-metal technology (operates at 1.3x FLC)
- Uses the magnetic effect of short circuit currents to offer shorttime short circuit protection

Thermomagnetic MCB & MCCBs

Advantages

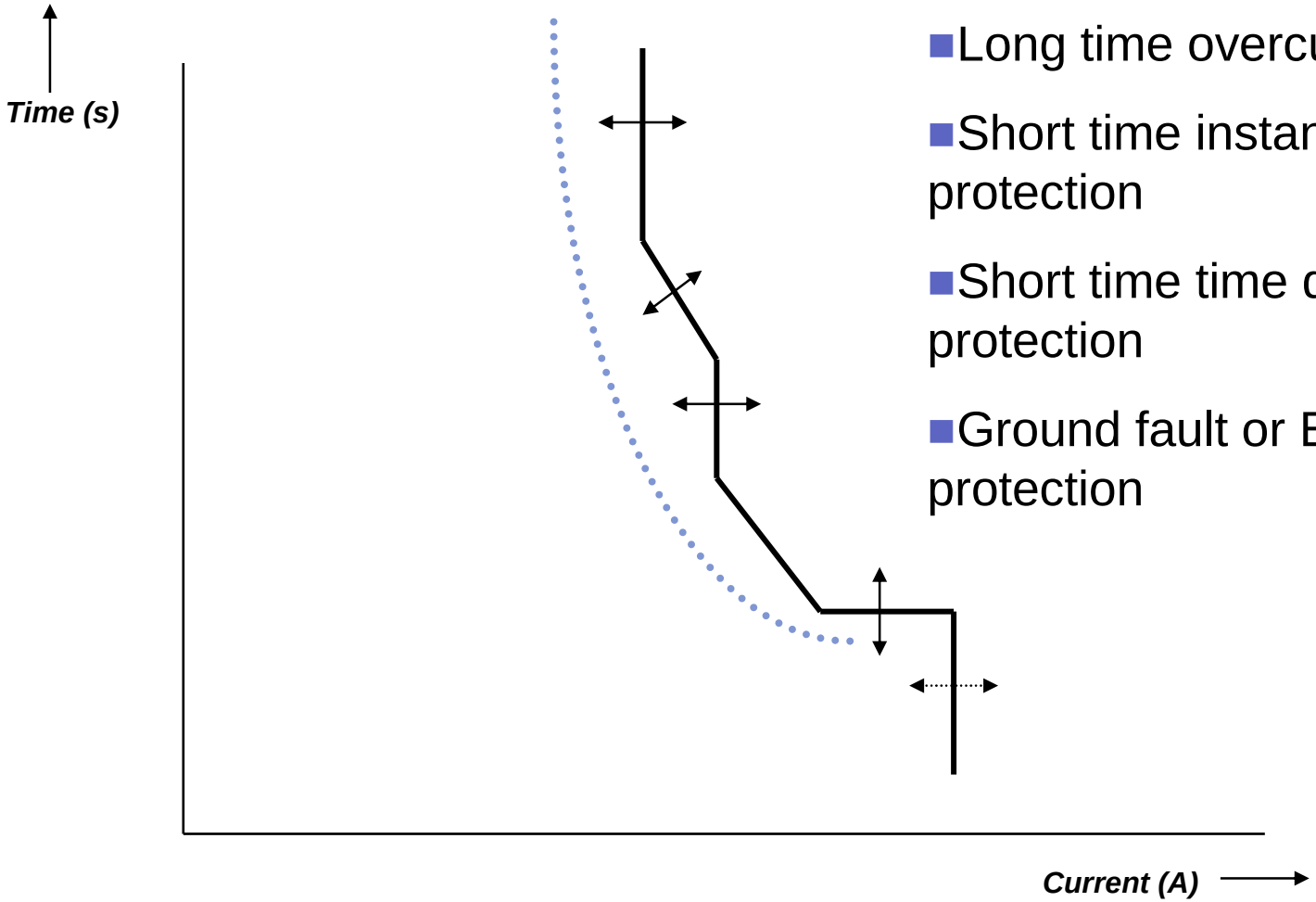
- Small size at low current ratings (MCB)
- Easily automated – shunt trip/ UVR/ Motor operator (MCCB)
- Difficult to compromise system protection
- Multishot protection before manual intervention (at least 2 shots)
- Non-deterioration of protection element with age or current stress
- Better overload protection leads to optimisation of cable sizing

Disadvantages

- Limited data extraction ON/OFF, Tripped (MCCB)
- Expensive replacement of protection element as switch contacts are used in arc clearance
- More complex discrimination
- Poorer current limitation than equivalent fuse

Electronic Relays

- Overcurrent functions such as:-
  - Long time overcurrent
  - Short time instantaneous protection
  - Short time time delayed protection
  - Ground fault or Earth fault protection



Electronic ACB & MCCBs

Advantages

- Lower cost at 630A and above than fuse equivalent
- Easily automated – shunt trip/ UVR/ Motor operator
- Difficult to compromise system protection
- Multishot protection before manual intervention (at least 2 shots)
- Non-deterioration of protection element with age or current stress
- Better overload protection leads to optimisation of cable sizing
- Complex functionality
- Wide ranging data extraction

Disadvantages

- Expensive replacement of protection element as switch contacts are used in arc clearance
- More complex discrimination due to complexity of protective functions
- Poorer current limitation than equivalent fuse

Relay functionality

STANDARD RANGE OF PROTECTION FUNCTIONS:

Overload

Short Circuit (with or without time delay)

Earth fault

High complexity protection functions:

Minumum / Maximum / Residual voltage protection

Phase imbalance

Inverse power flow

Directional Protection

Restricted earth fault

Standby earth fault

Zone Discrimination

Measurements

- Amps
- Volts
- Power
- Trip information (Phase/ current/ date/time)
- Data logging
- Maintenance indication
- No. of operations
- Settings
- Harmonic content

All capable of being transmitted either visually or by data stream

Conclusions

- The choice of protective device needs to be considered taking the requirements of the installation and the end client into consideration

Examples:-

- Within a remote installation, the automation capabilty to restore power remotely after a fault condition without human intervention may be critical to the needs of the end client requiring the use of circuit breakers capable of transmitting information on the level of fault current cleared
- When protecting particular equipment, such as inverter drives for example, the high current limiting effect of fuses may be critical to sucessful protection of the thyristor circuits.

Conclusions

- These examples are extreme and generally both fuse or fuseless technology can be used sucessfully within the majority of installations.

- The choice is yours…. The secret is to be aware of the capability of the technology you are using and to design your installation within the limits of the protection you have chosen

- ABB has been manufacturing both circuit breakers and switchfuses for many years, research and development within both technologies continues to increase the capabilities of the products we supply to make sure that whatever technology you choose, there is a suitable product within the range to meet your protection requirements .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