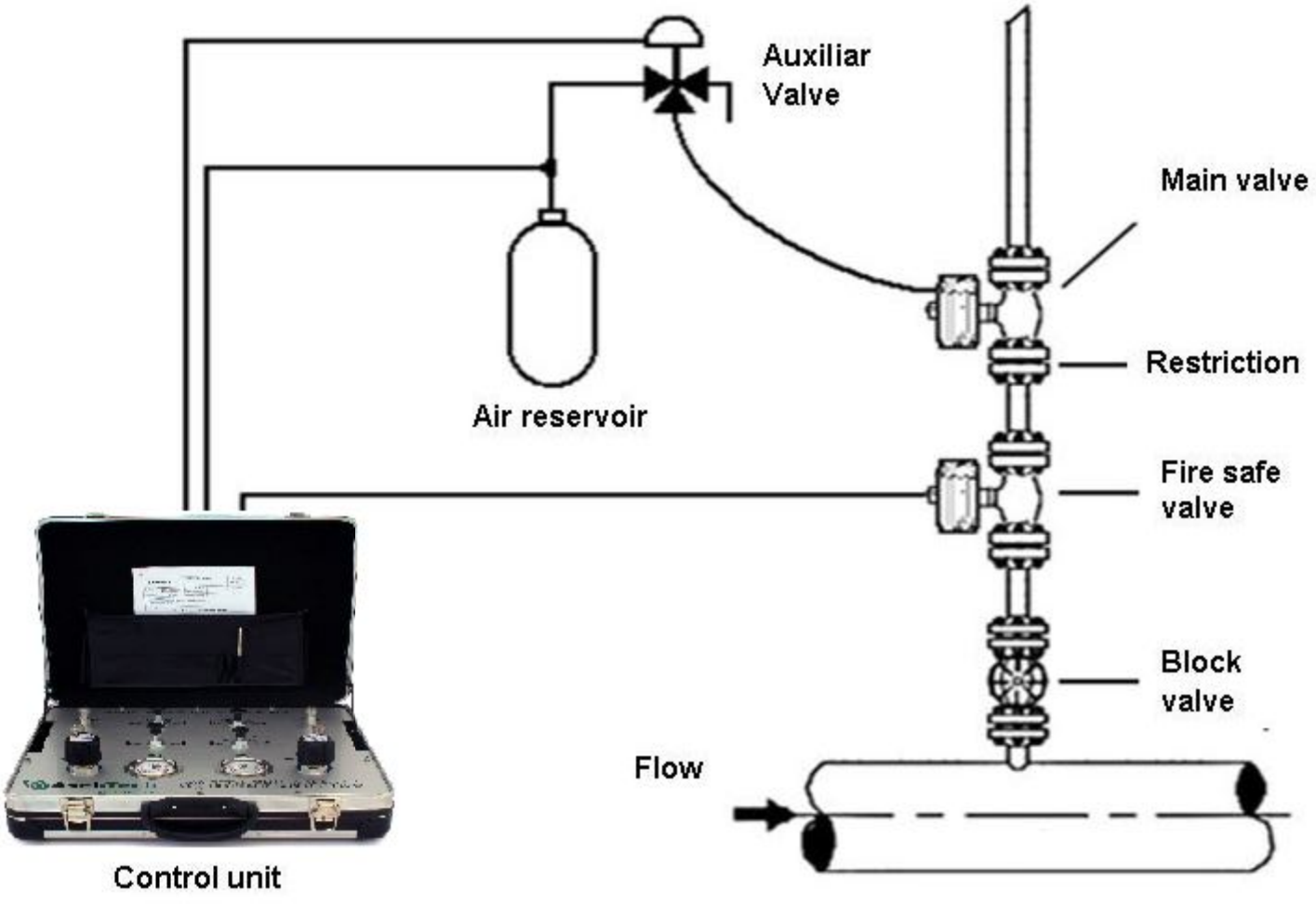
Test Kit



Based on Pneumatic Valves

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WELCOME

Statutory requirements regarding use of equipments *in* Oil Mines

ISA,5th October,2012 at New Delhi

Organizational Set-Up of DGMS

- Directorate General Of Mines Safety (DGMS) is a subordinate office under the Ministry of Labour & Employment, Govt. of India, having headquarters at Dhanbad.

- Entrusted with the responsibility to administer the Mines Act, 1952 and subordinate legislations.

- This office was set up on 7th January 1902.

INSPECTION OFFICES OF DGMS

Spread as widely as our mineral resources

Zonal Offices
at

Bangalore

Dhanbad

Ghaziabad

Hyderabad

Nagpur

Ranchi

Sitarampur

Udaipur

Outlying Regional/ Subregional Offices at
Ahmedabad
Bellary
Bilaspur
Bhuvaneshwar
Chaibasa
Chennai
Ghaziabad
Gouhati
Gwalior
Goa
Jabalpur
Koderma
Nellore
Parasia
Ramgarh
Raigaraha
Surat
Udaipur

Mines Act, 1952 and subordinate Legislations:

- Mining activities are regulated by the provisions of the Mines Act, 1952.

Three separate codes of regulations were framed under the Mines Act, 1952

- **The Coal Mines Regulations, 1957**
- **The Metalliferous Mines Regulations, 1961**
- **The Oil Mines Regulations, 1984**

Definition of Oil Mine

Defined in section 2(j)(i)

– *All borings, bore holes, oil wells and accessory crude conditioning plants, including the pipe conveying mineral oil within the oilfields.*

.

Why approval is required

- **Use of faulty machinery, equipment etc., resulted in accidents, disasters and dangerous situations.**

- **This led to framing of mine safety legislation requiring approval**

Concept of hazardous areas in oil mine

- **Oil or gas mine do have hazardous and non-hazardous locations**
- **Broadly, hazardous area means area where hazardous atmosphere exists or is likely to occur.**
- **Hazardous atmosphere means an atmosphere containing any flammable gas in concentration capable of ignition.**

Concept of hazardous areas in oil mine- **Classification….**

- **Zone ‘0’ hazardous area**

  -hazardous atmosphere is continuously present.

- **Zone 1 hazardous area**

  - hazardous atmosphere is likely to occur under normal operating conditions.

- **Zone 2 hazardous area**

  -hazardous atmosphere is likely to occur under only abnormal operating conditions.

Equipment and materials requiring approval

- Any specific equipment or material listed through Gazette notifications under Reg.73(for general material) & Reg.75(for electrical equipments in hazardous areas)of OMR,1984

Such as &

- Environmental monitoring instruments and devices.
- Personal protective equipment
- Electrical equipment and cables
- All types of lights, lighting fixtures etc.

Approval procedure

- **Application shall be submitted in a proper Format by manufacturer.**
- **If overseas manufacturers conduct business in India through an Indian Agent, complete details of Indian agency shall be required. However, application shall be initially submitted by the foreign manufacturer only.**

- **For further correspondence, CEO/Owner/ proprietor shall furnish his written authorization for the purpose of follow up.**

Approval procedure

contd---

- **The equipment needs to conform to relevant Indian standards.**
- **In case there is no IS, relevant standards of the country of origin may be accepted on its merit.**
- **The following documents are required**

-Two copies of test certificates on proto type equipment ,of approved/accredited test laboratories.

-In case of imported items, test certificates of foreign origin may be accepted subject to the concerned laboratory figuring in the list of internationally accredited test laboratories.

Approval procedure

contd---

- **On the basis of application Field Trial permission will be given.**
- **After the field trial is successfully done, the user shall report performance to DGMS,**
- **A separate report by field office is also submitted.**
- **Based on the reports, approval is granted for a specified period.**

Approval procedure

- **In case of equipment, material for which no Indian standards exist, standards of manufacturing country may be accepted at the discretion of DGMS.**

Approval procedure-important points

- **During the scrutiny of application for approval, the following details will be examined:**
- **Existence of company,**
- **Adequacy of technical information,**
- **BIS certification,**
- **Authenticity and correctness of technical drawings,**
- **Test reports from test laboratories,**
- **The capability of manufacturer to provide equipment at a later date with sustained quality assurance etc.**

Wherever required, manufacturer's facilities will be inspected by the officer of DGMS.

Approval procedure-important points

- **The final approval will be normally for a period of 1 to 2 years.**
- **Subsequently, on application by manufacturer and satisfactory performance report from users, may be extended for 3 years.**
- **If any manufacturer is not successful to market his product, a maximum of 2 extensions of 2 years each may be accorded.**
- **Any subsequent considerations for the approval will be at the discretion of DGMS**

THANK YOU

*****

Concept of hazardous areas in oil mine- **Classification**….

- **In this regard, DGMS issued General circular vide no.1 (6)2001-Genl/3604 -3753 dated 12.9.2001 for guidance.**

- **The provisions of CEA (Measures relating to safety and Electric supply) regulations, 2010 also discussed about hazardous area classifications.**

  -- An area within fifteen meters of a producing wellhead or any point of open discharge of the crude there from or other point where emission of hazardous atmosphere is normally likely to arise.

Concept of hazardous areas in oil mine-**Classification**….

-- An area within 4.5m of

(a) any producing well–head having a closed system of production

(b) exploration or interspaced wellhead being drilled in an area or

(c) an oil well which is being tested other than by open flow.

Products Standardization in Oil & Gas Sector in India

Dr (Smt) Vijay Malik,
Scientist 'F' & Head (PCD)
Bureau of Indian Standards
New Delhi, India.

Introduction

- Bureau of Indian Standards (BIS), works under the aegis of Ministry of Consumer Affairs, Govt. of India and operates its various activities, governed by Bureau of Indian Standards Act, 1986 and Rules and Regulations framed there under.
- BIS has been entrusted the job of formulation of National Standards under an Act of Parliament.

Activities of BIS

- Formulation of National Standards
- Certification Schemes
  - Product Certification
    - Voluntary & Mandatory
  - Hall Marking of Gold Jewellery
  - Imported Goods Certification
  - ECO Mark Scheme
  - Quality System Certification (IS/ISO 9001)
  - Environmental Management System Certification (IS/ISO 14001)
  - Hazard Analysis & Critical Control Points (HACCP) Certification (IS 15000)
  - Occupational Health & Safety Management System (OHSMS) Certification (IS 18001)

……Contd….

Activities of BIS (contd.)

- Laboratory Services
- Training Services
- Information Services
  - Technical Information Service Centre
  - Library Services
  - Small Scale Industry Facilitation & Information Cell

Formulation of National Standards

- The Indian Standards are formulated in a transparent manner through a consensus process by the Technical Committees comprising of experts from all concerned areas such as Consumers, Producers/ Manufacturers, R&D Centres, NGOs, Regulatory Bodies etc.
- The Bureau has published over 18000 standards so far.

…Contd….

Formulation of National Standards

- In BIS, the Indian Standards are formulated through following 14 Division Councils :
  - Production and General Engineering Division Council (PGDC)
  - Chemical Division Council (CHDC)
  - Civil Engineering Division Council (CEDC)
  - Electro-Technical Division Council (ETDC)
  - Electronics & Telecommunication Division Council (LITDC)
  - Food and Agriculture Division Council (FADC)
  - Mechanical Engineering Division Council (MEDC)
  - Management and Systems Division Council (MSDC)
  - Metallurgical Engineering Division Council (MTDC)
  - Petroleum, Coal & Related Products Division Council (PCDC)
  - Transport Engineering Division Council (TEDC)
  - Textile Division Council (TXDC)
  - Water Resources Division Council (WRDC)
  - Medical Equipment & Hospital Planning Division Council (MHPC)

Is it mandatory for all manufacturers to adopt Indian Standards?

- Adoption of Indian Standards is generally voluntary in nature and their implementation depends on adoption by concerned parties. An Indian Standard becomes binding if it is stipulated in a contract, referred to in a legislation or made mandatory by specific orders by the Central or State Governments.

Status of Implementation of Indian Standards on Petrol & Diesel

- Ministry of Petroleum and Natural Gas implements Indian Standards on Motor gasoline and diesel in the country. According to the Govt. Gazette notification

- 'High speed diesel means any hydrocarbon oil which meets the requirements of Bureau of Indian Standards Specification No. IS 1460 or any other requirement specified by the Central Govt. from time to time," and

- Motor spirit means any hydrocarbon oil which meets requirements of Bureau of Indian Standards specification no. IS 2796 or any other requirement specified by the Central Govt. from time to time,"

Development of Indian Standard – A Project Approach

Sl. No.	Project Stage	Associated Doc	Stages at the ISO Level	Remarks
1.	Proposal	New Work Item Proposal (NWIP)	New Work Item Proposal (NWIP)	Request for new standard constitute a proposal
2.	Preparatory	Working Draft (WD)	-	Proposal usually is accompanied with WD.
3.	Committee	Preliminary Draft (P-Draft)	Committee Draft (CD)	WD modified by the Member Secretary becomes the P-Draft.
4.	Approval	Wide Circulation Draft (WC)	Draft International Standard (DIS)	P-Draft modified by the Committee becomes the WC Doc.
5.	Publication	National Standard	International Standard	WC Doc is finalized by the Committee based on comments received.

International Activities

- BIS is a founder Member of ISO and continues to take active part in International Standardization.
- DG, BIS has functioned as Regional Liaison Officer (RLO) for South-Asia for two terms.
- BIS is a Participating P-Member of 61 Technical Committees of ISO.
- BIS holds secretariat responsibilities of 2 Technical and 6 Subcommittees.
  - ISO/TC 34/SC 7 – Spices & Condiments
  - ISO/TC 113 – Hydrometry
  - ISO/TC 120 – Leather
- BIS functions as the National Enquiry Point as nominated by the Ministry of Commerce, the dealing Ministry with WTO. India is a signatory to the WTO-TBT Agreement.

International Committees in Petroleum Sector

- BIS participating on behalf of India in ISO/TC 28 Petroleum products and Lubricants ,
- ISO/TC193 Natural gas;
- ISO/TC 238 Solid Fuels and
- A new committee for Biogas as ISO/TC 255.

Harmonization of Standards

- Currently there is no mechanism in place to collect and disseminate standards in Asia, for example Fuel standards.
- Socio economic differences in Asia are large and will not allow for harmonization in the short term. Also within countries, there are considerable regional differences.

Harmonization of Standards Contd…

- Harmonization has four stages
- 1) Information sharing
- 2) Debating harmonization
- 3) Deciding on harmonization and
- 4) Implementation of standards.
- The current pattern in India is to duplicate European emission standards and related fuel standards.

Harmonization of Standards

- Harmonization can mean having the same goal but different time schedules to reach the common goal.
- Awareness raising and consensus building on the advantage and disadvantage of harmonization are very important.
- Certain countries, like India have strict standards for specific hot spots rather than same standards at entire National Level.
- There could be a concern that harmonization of standards may become reason for watering down standards in some part of the world.

Petroleum, Coal and Related Products Division Council (PCDC)

- **The Indian Standards in the area of petroleum, coal and related products are formulated through following Sectional Committees :**
  - **Methods of Measurement and Test for Petroleum, Petroleum Products & Lubricants, PC 1**
  - **Petroleum, Lubricants & Their Related Products, PC 3**
  - Bitumen, Tar and Their Products, PC 6
  - Solid Mineral Fuels, PC 7
  - Organic Chemicals, Alcohols & Allied Products and Dye Intermediates, PC 9
  - Plastics, PC 12
  - Rubber & Rubber Products, PC 13
  - Natural and Synthetic Fragrance Materials, PC 18
  - Cosmetics, PC 19
  - Plastic Containers, PC 21
  - Sports Goods, PC 22

Methods of Measurement and Test for Petroleum, Petroleum Products & Lubricants, PCD 1

- This Sectional Committee deals with Measurement, Methods of Sampling and Methods of Test for Petroleum Products and Lubricants
- Indian Standards on Methods of Sampling are covered under various parts of IS 1447 and Indian Standards on Methods of Test are covered under various parts of IS 1448.
- Thus far over 162 Indian Standards have been formulated under this Sectional Committee

Structure of PCD1

- Instrumental Methods Subcommittee, (PCD 1:1)
- Machines Test Subcommittee, (PCD 1:2)
- Physico -Chemical Subcommittee, (PCD 1:3)
- Static & Dynamic Measurement and Test for Petroleum and Products Subcommittee (PCD 1:4) which has been transferred to Production and General Engineering Department (PGD) namely PG 26 ‘Weights and Measures Sectional Committee’ recently since the area of Instrumentation, Measurement and Legal Metrology is very specialized

Petroleum, Lubricants & Their Related Products Sectional Committee , PCD 3

- This Sectional Committee is responsible for formulation of Indian Standards in the area of Petroleum, Lubricating Oils, Greases, Hydraulic Fluids, Corrosion Preventives, Quenching and Cutting Oils etc.

- Thus far over 135 Indian Standards have been formulated under this Sectional Committee

Structure of PCD 3

- Automotive, Aviation and Industrial Fuels Subcommittee, PCD 3:1
- Aromatic hydrocarbons, Petroleum solvents and Preservatives Subcommittee, PCD 3:2
- Automotive lubricants Subcommittee, PCD 3:3
- Industrial Lubricant & Specialty Products Subcommittee, PCD 3:4
- Gas Fuels Subcommittee, PCD 3:5
- Panel for Engine and Gear Oil Qualification Approval PCD 3:P1

Indian Standards on Petroleum Products

Motor gasoline, diesel ,bio-diesel and others

Fuels Standards Development

- A close knit set up of Technical Committees is in practice in BIS
- Systems approach being followed in setting and reviewing fuel standards by the technical committee with sound understanding of the impact of fuel on emissions, Health Impacts and the economic costs, financial impact for producer, distributor and consumer including the linkage with vehicle standards and engine technology.
- Involvement of different stakeholders such as Govt., Private Sector and Civil Society to avoid polarization.

Fuel Standards Development

- Parameters that need regulation in Motor Gasoline are Lead, Sulphur, Reid Vapour Pressure, Research & Motor Octane Number, Distillation, Density, Corrosion, Oxidation Stability, Benzene, Aromatics and Olefins etc.

- For Diesel, these include Acidity, carbon residue, Sulphur, Distillation, Density, Aromatics, Ash content, flash point, kinematic viscosity, sediment, oxidation stability, oxygen content and Cetane Number etc.

- Deposit Control Additives help emission performance and need careful consideration. For example, use of MTBE though reduces tailpipe emissions but contaminates ground water. Therefore, flexible but precautionary approach is taken while laying standards.

Fuel Standards Development

- State of art vehicle emission technology equivalent to Euro III or Euro IV requires control of level of lead and sulfur in gasoline and level of sulfur in diesel.
- The affordability, availability and cost factors are important.
- There may not be any problem in new vehicles, however difficulty of implementation is mainly in old vehicles

IS 1460:2005 DIESEL FUELS - SPECIFICATION

- This Indian Standard was first published in 1959 and subsequently revised in 1968, 1974, 1995, 2000 and 2005.
- In the present version, specification for high speed diesel fuel for the vehicles meeting Bharat Stage IV (EURO IV equivalent) Emission norms have been covered while retaining requirements for Bharat Stage III as well through a recent amendment No. 2 issued in March 2010.

IS 1460:2005 DIESEL FUELS - SPECIFICATION

- Provision of blending of bio-diesel up to 5% (v/v) with High Speed Diesel (HSD) has been made in the standard and following new requirement has been incorporated:

  Oxygen content, % by volume, Max – 0.6

IS 1460:2005 Diesel Fuels – Specification (Fifth Revision)

This standard earlier covered requirements for high speed diesel as well as light diesel oil which have been separated in the fifth revision. There is a separate standard for light diesel oil now.

- Cetane Number has been gradually increased from 42 minimum to 51 minimum over a period of several years to improve the quality.

- The requirement of flash point was lowered from 55 deg. C to 38 deg. C in 1974 which was further relaxed to 32 deg C in 1981 to absorb surplus stock of heavy naptha into high diesel oil to tackle imbalance in the production of HSD as well as to cater to the increasing demand. In the existing version, flash point is 35 deg C .

- Similarly requirement of total sulphur has been reduced to 50 mg/kg maximum from 350 mg/kg maximum in Bharat Stage IV from Bharat Stage III.
- Cold filter plugging point (CFPP) has been incorporated to take care of low ambient temperatures.

IS 2796:2008 MOTOR GASOLINE - (Fourth Revision)

- This Indian Standard was first published in 1964 and subsequently revised in 1971,1995, 2000 and 2008.
- In the present version two grades of unleaded motor gasoline such as BS III and BS IV complying with respective emission norms have been covered.
- 5% Ethanol blending in motor gasoline has been prescribed
- …contd….

IS 2796:2008 MOTOR GASOLINE - SPECIFICATION

- Provision of 10% Ethanol Blending in motor gasoline (E10) has been made.
- Requirements for protection of engines in view of blending with organic oxygenates such as alcohol and ethers have been made by making addition of anti-oxidants and MFA mandatory for E10.

IS 2796:2008 Motor Gasoline – Specification (Fourth Revision)

- Octane Number has been gradually increased from 83 to 91/95.
- Requirement of vapour lock index was introduced in addition to distillation and reid vapour pressure to prevent vapour lock problem in hot weather condition.
- Use of organic oxygenates like MTBE, Ethanol, Methanol etc. has been prescribed to prevent phase separation of gasoline alcohol blends.
- Requirement of sulphur content total has been made stringent to 50mg/kg maximum in Bharat Stage IV. Besides aromatic content , percent by volume maximum has been limited to 35.

Some of Important Indian Standards other than petrol & diesel under PCD 3

- IS 1012:2002 Turbine Lubricating Oils – Specification (Third Revision)
- IS 1459:1974 Specification for Kerosene (Second Revision)
- IS 1571:2008 Aviation Turbine Fuels, Kerosene Type Jet, A-1-Specification (eighth revision)
- IS 1604:1994 Aviation gasoline – Specification (Third Revision)
- IS 3470:2002 Specification of Hexane, Food Grade (first revision)
- IS 4576:1999 Liquefied Petroleum Gases – Specification (second Revision)
- IS 5759:2006 Anti-freeze coolant – Specification (Second Revision)

Contd.

- IS 8654:2001 Automotive Hydraulic Brake Fluid, Heavy Duty (Second Revision)
- IS 13656:2008 Internal Combustion Engine Crankcase Oils (Gasoline and Diesel) (Second Revision)
- IS 14234(Part 1):2002 Lubricants for spark ignition air-cooled gasoline (Part 1) Two Stroke Spark ignition air-cooled gasoline (first Revision)
- IS 14861:2000 Liquefied Petroleum Gases (LPG) for automotive purposes

Current Need for standardization

- There is a need for R&D and development of data bank to prevent any further conflicts of views on the specifications of various products like diesel, motor gasoline, biodiesel, ethanol for automotive purposes etc.

- Active participation of various stake holders like regulatory authorities, manufacturers, users, consumer organizations, R&D institutes, Academician, etc is desired to obtain consensus on a subject and in formulating an internationally competent Indian Standard.

Bio-diesel

- Bio-diesel in India is made from non-edible vegetable oil (*Jatropha Curcas* and *Pongamia Pinnata* ('Honge' or 'Karanja') plants) through trans-esterification.

- Blending of Bio-diesel with diesel has been done for reducing the air pollution due to substantial reduction of un-burnt hydrocarbons, carbon monoxide and particulate matter as this has almost no sulphur, no aromatics and about 10% built-in oxygen which help in ensuring complete combustion, improves lubricity of low sulphur diesel fuels, required for meeting Euro III and Euro IV emission norms.

IS 15607 : 2005 Biodiesel (B100) Blend Stock for Diesel Fuel - Specification

This standard prescribes the requirements and methods of sampling and tests for bio-diesel suitable for fuel in diesel engines for use as a blend component (up to **20** percent) with diesel fuel. Bio diesel based on ***Jatropha Curcas*** and ***F'ongamia finnata (*** 'Honge' or 'Karanja') plants is to be used for this purpose.

Conventional Fuels

- In order to use fuel standards as a tool in reducing air pollution it is important to have information on air quality, public health standards, actual vehicle emissions and fuel quality.
- An integrated framework is required that addresses traffic management, technology choice, vehicle maintenance etc.
- Decisions on fuel standards are directly interrelated with refinery capability and refining capacity.
- The cost required to modify refineries is an important concern.
- In order to implement stricter fuel standards and increase the acceptability of the associated costs for consumers, awareness campaigns are required.

Alternative Fuels

- India has made a beginning to implement fuel switching mostly for public transport vehicles in capital: buses, taxis and three wheelers.
- Liquid Petroleum Gas (LPG) and Compressed Natural Gas (CNG) are most important alternate fuels. IS14861:2000 LPG for automotive purpose while Indian Standards on CNG as well as Bio-gas are under print.
- The emission impact of alternative fuels is largely dependant on vehicle technology, maintenance of vehicle.
- As a general rule, purpose built engines for exclusive use of CNG or LPG are cleaner and efficient than converted engines.
- Di Methyl Ether (DME) is another thrust areas.

Alternate Fuels ….. Contd.

- In order to promote alternate fuels, it is necessary to review
  - Emissions resulting from the use of alternative fuels;
  - Safety of alternative fuels;
  - Financial benefits to the end users;
  - Experiences in other countries;
  - Success stories and examples of best practice;
  - Servicing information of vehicles

Expectations from Regulatory Authorities

- Set standards for fuel quality in a consultative manner and review standards from time to time.

– Exercise control over the quality of fuel (adulteration) and strengthen fuel testing

– Eliminate subsidies that favour fuels that result in high levels of emissions;

– Ensure cleaner fuels and lower polluting vehicles are more attractive to consumers

– Develop better transport system for better utilization of the road network and limit the unnecessary use of fuel.

Expectations from Oil and Gas Industry

- Take the initiative to bring in best technology
- Take on responsibility to overcome adulteration during production and distribution and contribute to campaigns to prevent end-use adulteration.

Expectations from Motor Vehicle Industry (OEM)

- Provide cleanest possible vehicle technology meeting emission standards and fuels availability.
- To co-operate with the oil industry on the development of appropriate fuels by sharing technical information;

Expectations from Consumer Organizations/NGOs

- Consumer Organizations/NGO to be well informed, aggressive with a clear message
- to publicize adverse impacts on health;
- to push for health studies in local areas;
- to push government for adequate fuel and vehicle standards.

Expectations from R & D Organizations

- To determine the impact of fuel use on air pollution, relationship between fuel quality and emission of engines.
- Relationship between fuel quality and lubricant specifications.
- Special attention to unregulated emissions like formaldehyde; acetaldehyde; 1,3 butadiene etc. with increase in usage of alternate fuels like CNG

How to see List of published Indian Standards on Petroleum Products

- List of Indian Standards published so far in the field of petroleum& Lubricants can be seen at www.bis.org.in

- For any queries mail to pcd@bis.org.in


Thanks for your
Patient Listening

SURGE PROTECTION – A CASE STUDY

JITENDRA CHAUDHARI
NAKUL GUPTA

BECHTEL INDIA PVT.LTD, NEW DELHI

ISA(D) PNID 2012, New Delhi October 5th, 2012

SURGE AND TRANSIENT - DEFINITION

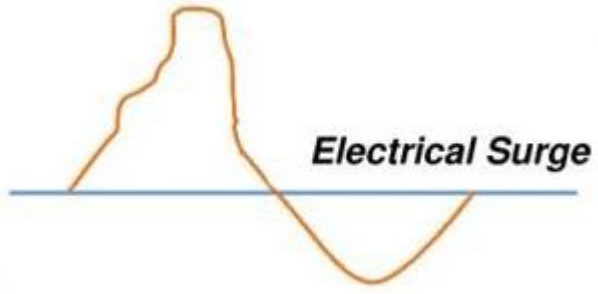
- Surges and Transients are sudden, brief (few microseconds) rises in voltage and/or current to a connected load.
- The dividing line between surge and transient is fuzzy.

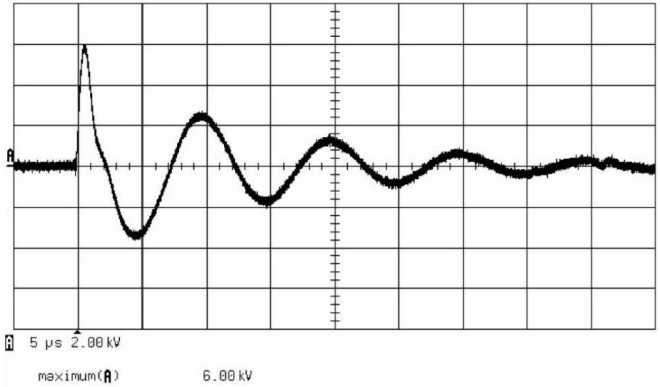
SURGE

- Surges are slow, prolonged and with very high total energy.
- They are caused by lightning strikes or excessive AC voltage due to faulty wiring.

TRANSIENT

- Transients are very fast but with low total energy.
- They are mainly associated with Emergency Shutdown Of Electrical Equipment or Inductive Kickbacks.





SOURCES OF SURGE

- Surges and Transients are caused due to sudden change in electrical conditions of the circuit.
- Sources can be both within the system and due to external environment.

External sources

1. Lightning
2. Transformer switching ON/OFF
3. Powerline connection and disconnection
4. Electrostatic discharging
5. Switching of (ON/OFF) capacitor banks

SOURCES OF SURGE

Internal sources

1. Circuit breakers or fuses
2. VSD generators
3. Air conditioners
4. Electric motors

- Most often the internal surge sources like VSD , welding have reliable mitigation techniques.
- External sources like lightning are uncontrolled which have caused plant shutdowns and hence pose a great risk.

CONSEQUENCE OF SURGE

- The oil and gas industry is a heavy user of sophisticated electric equipment for process control.
- Semiconductor circuits are more prone to failure due to the stress caused by a surge.
- Hence there is a need to use effective surge protection mechanisms to protect the process. Any absence of protective features can lead to :

1. Reduce Mean Time Before Failure (MTBF)
2. Failure , permanent degradation
3. Increased maintenance cost
4. Loss of revenue due to process shutdown
5. Loss of life and property.

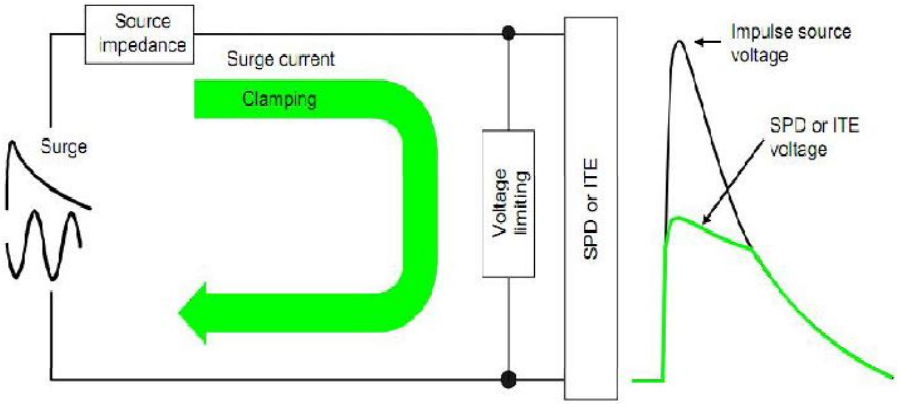
TECHNOLOGY AVAILABLE FOR SURGE PROTECTION

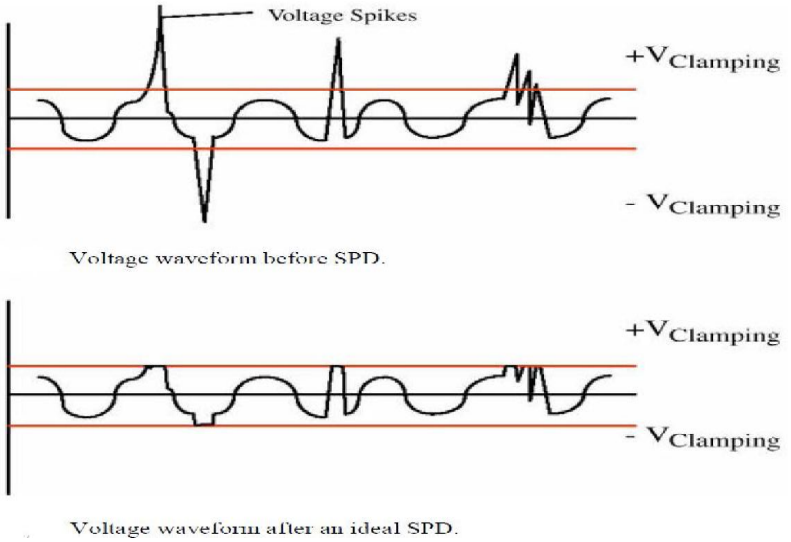
- VOLTAGE LIMITING:

VOLTAGE LIMITING DEVICE

- VOLTAGE SWITCHING

- Shunt connected SPD which have high impedance when no surge is present.
- They continuously reduce resistance with increasing surge voltage and current.
- They are sometimes called “clamping” type components.
  - Metal Oxide Varistor (MOV)
  - Silicon Avalanche Diodes (SAD)

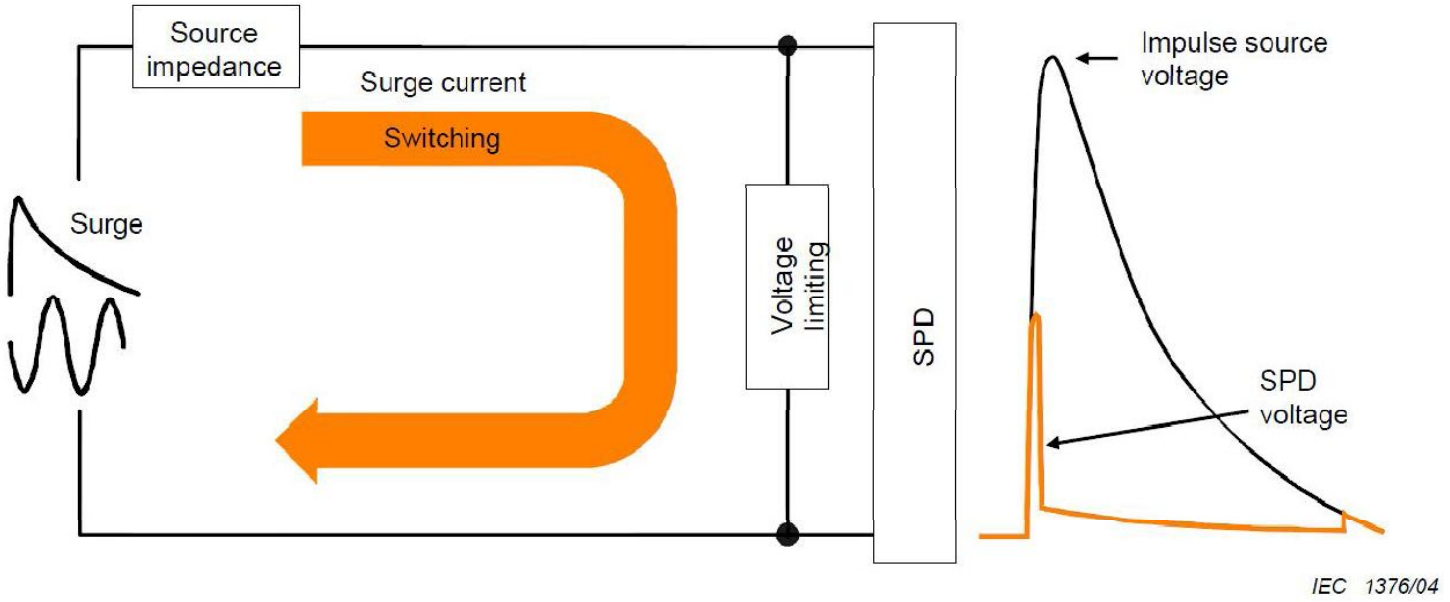




TECHNOLOGY AVAILABLE FOR SURGE PROTECTION

VOLTAGE SWITCHING DEVICE

- Shunt connected SPD which have high impedance when no surge is present.
- They have a sudden change in impedance to a very low valve in response to surge voltage.
- They are sometimes called “Crowbar” type components.
  - Gas Discharge Tubes (GTD)



Circuit for voltage-switching devices

VOLTAGE LIMITING DEVICE

METAL OXIDE VARISTOR (MOV)

- They can withstand high voltages.
- They have short response time making it suitable for limiting rapidly changing voltages.
- They have high thermal capacity and can withstand high temperatures.
- They are the most commonly used components in Surge Protection Devices.
- They have high capacitance. This limits there use in high frequency applications.

Single-MOV-based SPD module.

Multiple-MOV-based SPD.

VOLTAGE LIMITING DEVICE

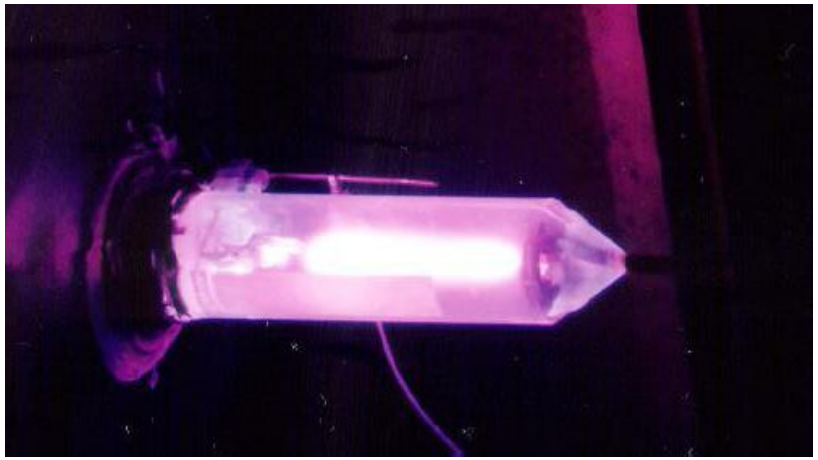
SILICON AVALANCHE DIODE (SAD)

- They are reversed biased P-N junction.
- They respond rapidly to voltage surge.
- They clamp the transient voltage to a very small residual voltage.
- They have very low energy withstanding capabilities.
- Though manufacturers combine several SAD to share energy, it has been found that in applications where frequent high energy transient voltages occur they are not a reliable protection measure.

VOLTAGE SWITCHING DEVICE

GAS DISCHARGE TUBE (GDT)

- They are rugged, relatively inexpensive and have a low shunt capacitance.
- They have the maximum current carrying capacity , upto 10kA peak.
- They are slow to conduct.
- In some situations they are difficult to turn off even after the transients have ended.
- When GDT switches from insulating stage to conduction stage, high value of dI/dT can pose problems for nearby equipments.



INTERNATIONAL SPD STANDARDS

International standards for evaluation of surge protection device performance and safety are :

- IEEE C62.41.1-2002 -IEEE GUIDE ON SURGE ENVIRONEMENT IN LOW VOLTAGE AC POWER CIRCUITS.

- IEEE C62.41.2-2002 –IEEE RECOMENDED PRACTICES ON CHARACTERIZATION OF SURGES IN LOW VOLTAGE AC POWER CIRCUIT.

- IEEE C62.45-2002 -IEEE RECOMENDED PRACTICES ON SURGE TESTING FOR EQUIPMENT CONNECTED TO LOW VOLTAGE AC POWER CIRCUIT

- IEC 61643-11 – SURGE PROTECTION DEVICES CONNECTED TO LOW VOLTAGE POWER DISTRIBUTION SYSTEMS

IMPORTANT SURGE PROTECTOR PARAMETERS

According to IEC 61643-11 following shall be available in SPD datasheet:

- Temporary overvoltage rating U_T
- Total discharge current I_{TOTAL} and the corresponding test class.
- Voltage drop across the surge protector.
- Load side surge withstanding capability.
- Information about replaceable parts.
- Voltage rate of rise du/dt
- Current factor K
- Modes of protection.

Other information which shall be provided with delivered product:

Location, Number of Ports, Thermal protection, Operating duty, Mounting Method, Degree of protection of enclosure.

Mandatory markings on the body of SPD:

Manufacturer's name and model number, Maximum continuous operating voltage, Voltage protection level.

PARAMETERS FOR SELECTION OF SURGE PROTECTORS

CONTROLLED AND UNCONTROLLED ENVIRONMENT

- The controlled environment is one within the managed environment of a building or other infrastructure.
- Uncontrolled environment is outside an enclosed structure in open.

PARAMETERS THAT MAY AFFECT NORMAL OPERATION

SPDs shall conform to application-specific requirements. Some SPD may influence the normal operation of an instrument. The following parameters should be considered :

- capacitance
- series resistance
- insertion loss

WHEN TO USE SURGE PROTECTION

The need for surge protection should be based on :

RISK ANALYSIS

Risk analysis takes into account following electromagnetic phenomenon

- Lightning discharge
- Power induction
- Earth potential rise

RISK IDENTIFICATION

Risk identification takes into account economic aspects such as:

- Costs (high repair costs of inadequately protected equipment versus no repair costs of adequately protected equipment, probability of occurrence of damaging electromagnetic phenomena)
- Intended application
- Protective measures in installations
- Continuity of the service - Availability

UNCONTROLLED SOURCE OF SURGE

LIGHTNING

- Thunderstorms come into existence when warm air masses containing sufficient moisture are transported to great altitudes.
- Electrostatic charge separation processes, e.g. friction and sputtering, are responsible for charging water droplets and particles of ice in the cloud.
- If the space charge densities, present in a thundercloud, produce local field strengths of several 100 kV/m, Lightning takes place.

Lightning flashes to earth are of two types:

⇒ Downward flash (cloud-to-earth flash)

⇒ Upward flash (earth-to-cloud flash)

- Objects struck by lightning are subject to higher stress by downward flashes (cloud-to-earth flashes) than by upward flashes (earth-to-cloud flashes).
- The parameters of downward flashes are therefore taken as the basis when designing lightning protection measures.

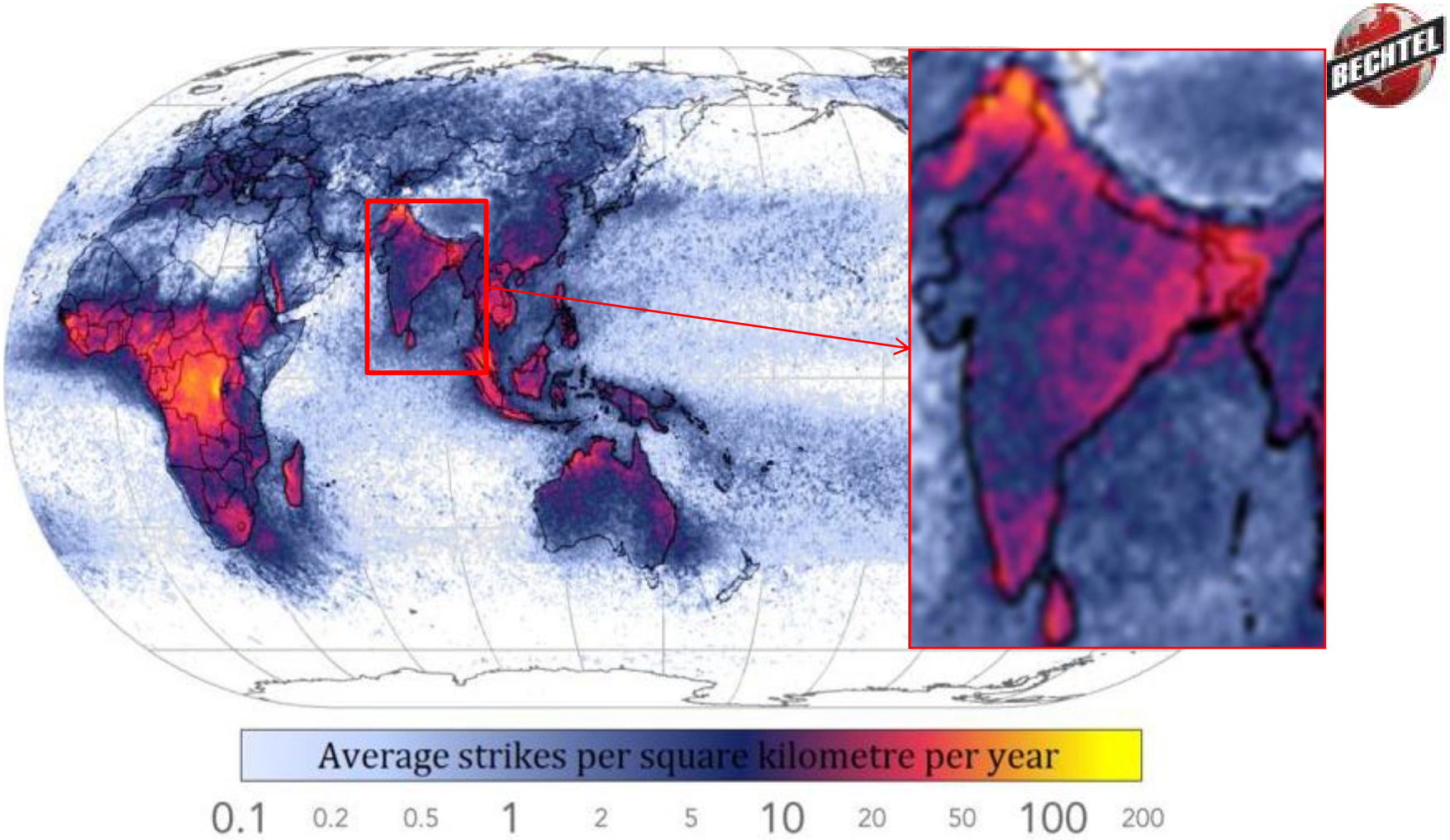
IDENTIFICATION OF LIGHTNING HAZARD

Keraunic Number

- The keraunic number is a system to describe lightning activity in an area based upon the audible detection of thunder.
- It is defined as the average number of days per year when thunder can be heard in a given area, and the likelihood thereby of a thunderstorm.

Flash Density Maps

- The keraunic number has been replaced by more accurate Flash Density maps.
- They collect data from both ground-based and satellite lightning detectors.



Flash Density Map Of World

CASE STUDY- ANTAPACCAY

- Antapaccay is a plant located in Cusco south east Peru.
- The site is located at 4200 m above sea level.
- It has a Keraunic level of 60 which means an average 60 thunder strikes per year.
- This a high value and hence requires additional protection of instruments from lightning induced surges.
- Due to past damage to field instruments at Antapaccay because of lightning, lightning protection measures were incorporated during engineering.

Based on the keraunic level and danger of lightning strike , Surge protection in Antapaccay for instruments was implemented at 3 levels:

1. Surge protection for Instrument's power supply input.
2. Surge protection for field cabinets- Junction Boxes and Control Cabinets.
3. Surge protection for field instruments .

CASE STUDY- ANTAPACCAY

IMPORTANT SURGE PROTECTOR PARAMETERS CONSIDERED

The following parameters were considered for selection of SPD:

- Working voltage
- Maximum continuous operating voltage
- Lightning impulse current (10/350 us)
- Maximum surge current (8/20 us)
- Nominal current
- Leakage current
- Voltage protection level line-line
- Operating temperature range
- Line resistance, Capacitance, Attenuation
- Electrical Connection

CASE STUDY- ANTAPACCAY

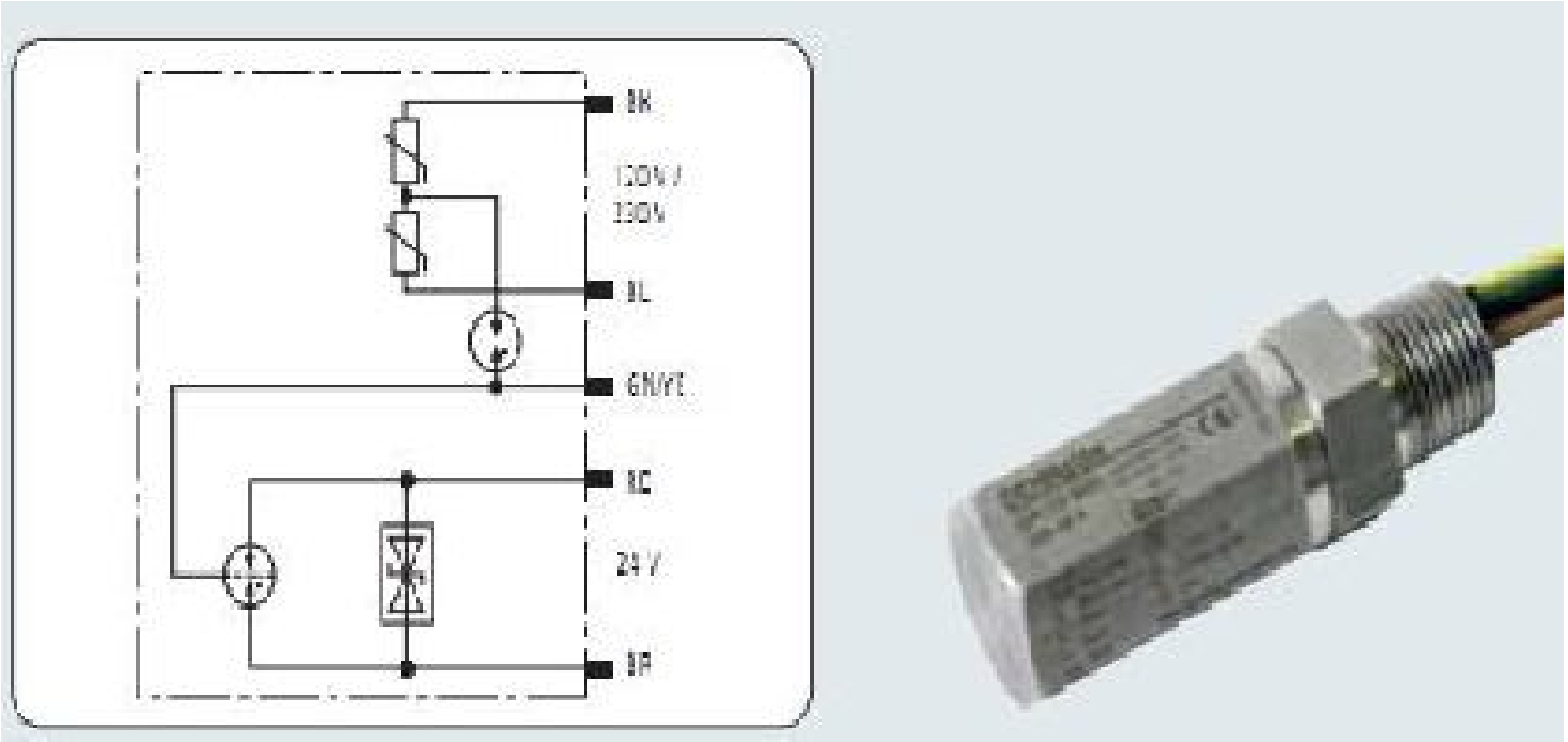
TYPICAL SPD DATASHEET

	DPI CD EXD 230 24 N
SPD class	TYPE 2
Nominal voltage [U_N]	24 V
Max. continuous operating d.c. voltage [U_c]	32 V
Max. continuous operating a.c. voltage [U_c]	22.6 V
Nominal current at 80° C [I_L]	0.55 A
D1 Lightning impulse current (10/350 µs) line-PG [I_{imp}]	1 kA
C2 Total nominal discharge current (8/20 µs) [I_n]	10 kA
Voltage protection level line-line for I_n C2 [U_p]	≤ 58 V
Voltage protection level line-PG for I_n C2 [U_p]	≤ 900 V
Voltage protection level line-line at 1 kV/µs C3 [U_p]	≤ 50 V
Voltage protection level line-PG at 1 kV/µs C3 [U_p]	≤ 850 V
Capacitance line-line [C]	≤ 25 pF
Capacitance line-PG [C]	≤ 15 pF
Operating temperature range	-40°C ... +80°C
Degree of protection	design in IP 67
For mounting on field/device side	1/2 14 npt male thread
Connection input/output	connecting leads 1.3 mm², length of 250 mm
Earthing via	connecting lead
Enclosure material	V4A
Colour	bare
Test standards	IEC 61643-21
Ex certifications	ATEX: KEMA 10ATEX0114 X; II 2 G Ex d IIC T5/T6 CSA 10.2317168, Ex d IIC T4
Approvals, Certifications	GOST
Protection of the energy side	----------
SPD according to EN 61643-11	Type 2
SPD according to IEC 61643-1	Class II
Nominal a.c. voltage [U_N]	120/230 V
Maximum continuous operating a.c. voltage [U_c]	255 V
Nominal discharge current (8/20 µs) L-N [I_n]	3 kA
Total discharge current (8/20 µs) L+N-PE [I_{total}]	5 kA
Voltage protection level L-N [U_p]	≤ 1.4 kV
Voltage protection level L/N-PE [U_p]	≤ 1.5 kV
Max. discharge current L-N [I_{max}]	3 kA
Max. supply-side overcurrent protection	16 A gI/gG or II 16 A

CASE STUDY- ANTAPACCAY

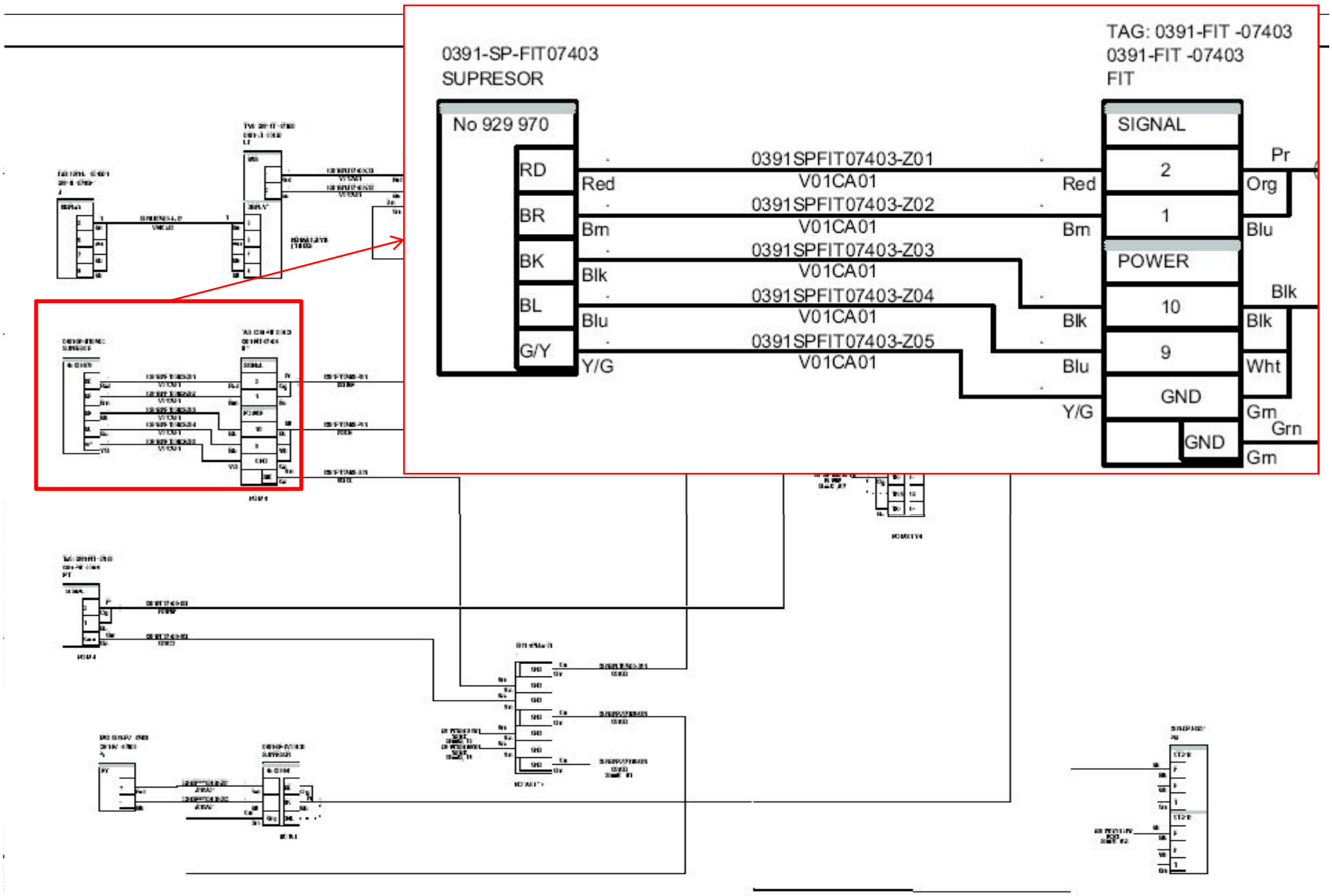
SURGE PROTECTION FOR INSTRUMENT'S POWER SUPPLY

A separate surge protector was used for 120 Vac, 1 Phase, 60Hz power supply system used to power externally powered instruments.
DEHN provided model number **929970** - 4 wire screwable surge protector for 120 Vac power supply.



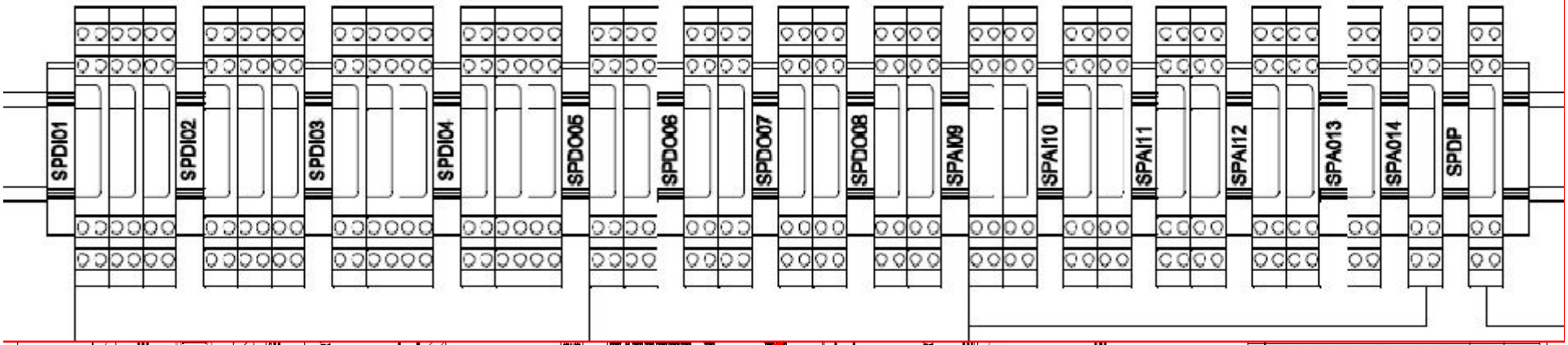
CASE STUDY- ANTAPACCAY

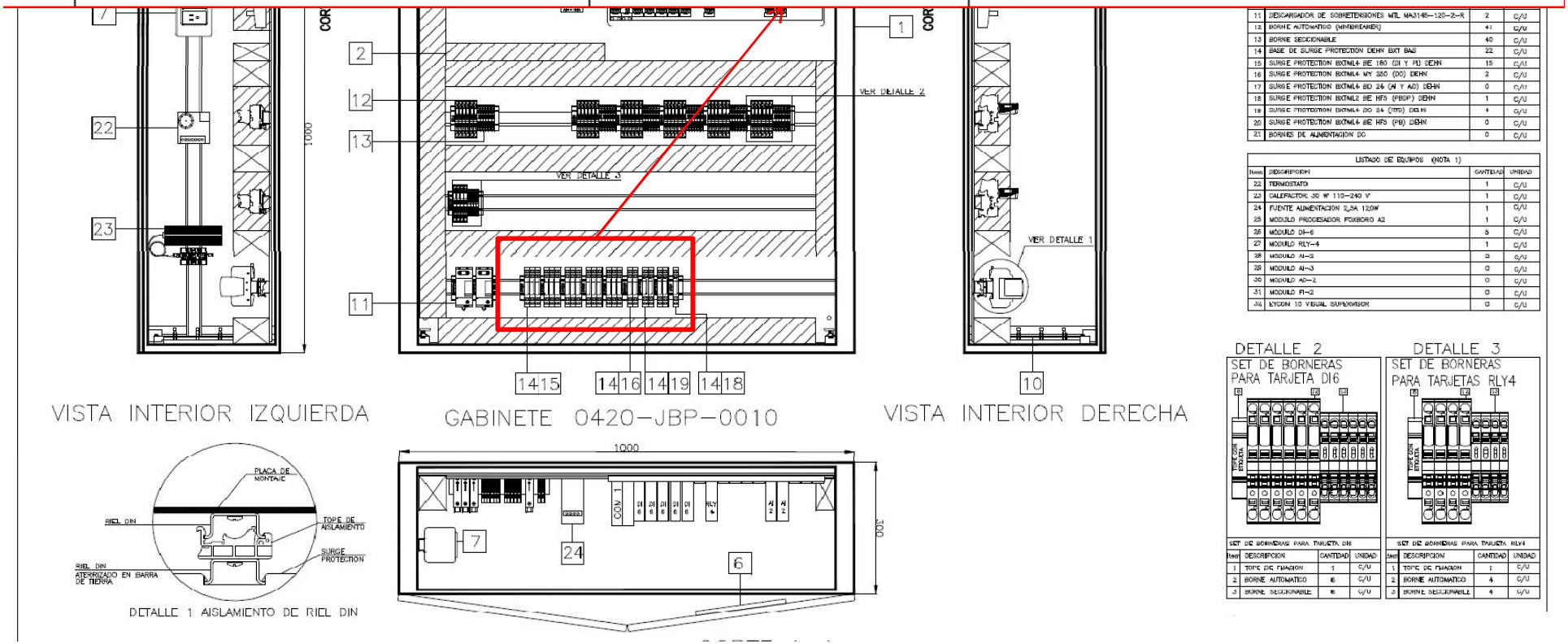
LOOP DIAGRAM FOR CONNECTION OF SPD TO INSTRUMENT POWER SUPPLY



CASE STUDY- ANTAPACCAY

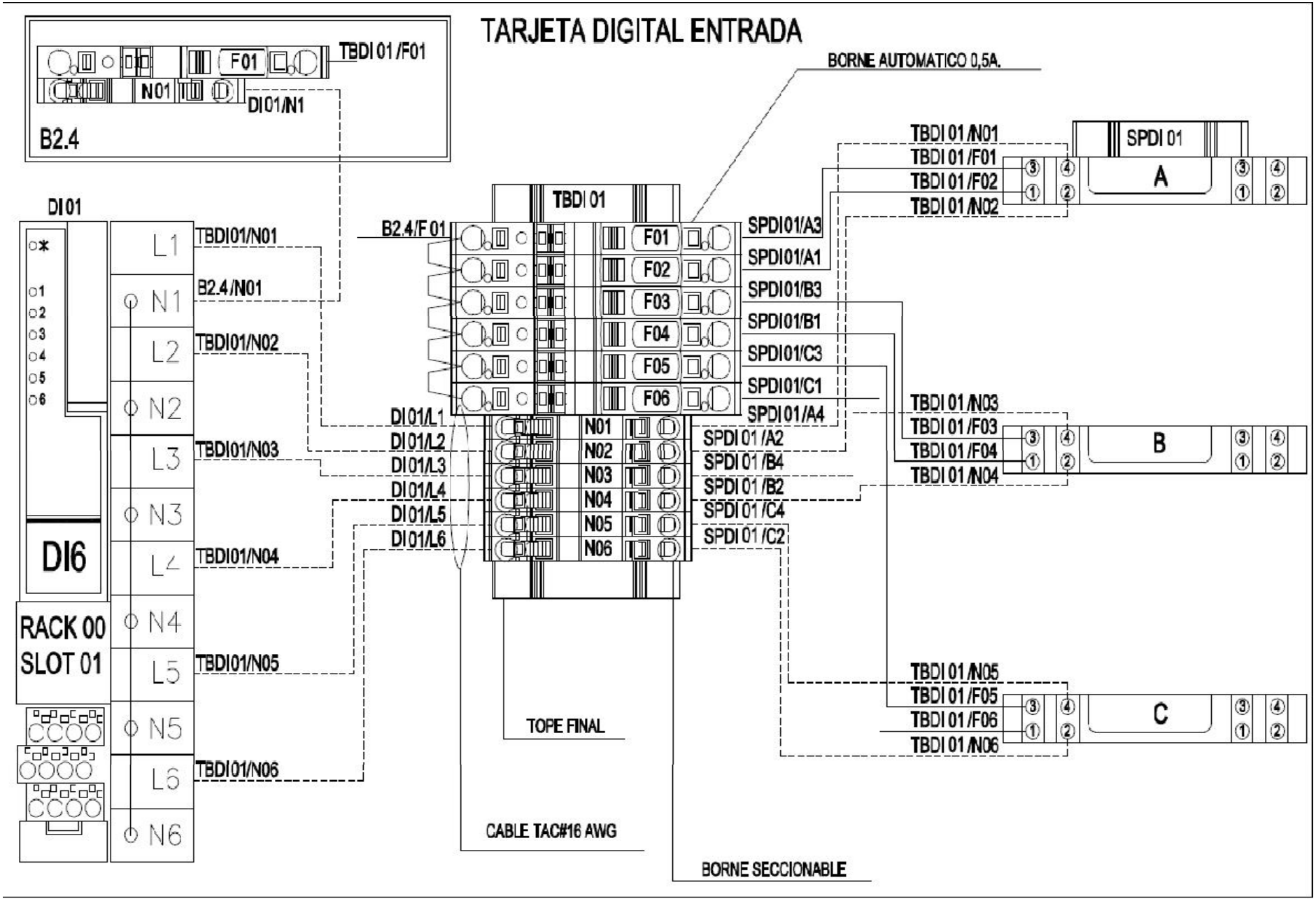
SPD IN FIELD CABINETS- JUNCTION BOX / CONTROL PANEL





CASE STUDY- ANTAPACCAY

CONNECTION OF SPD IN FIELD JUNCTION BOX

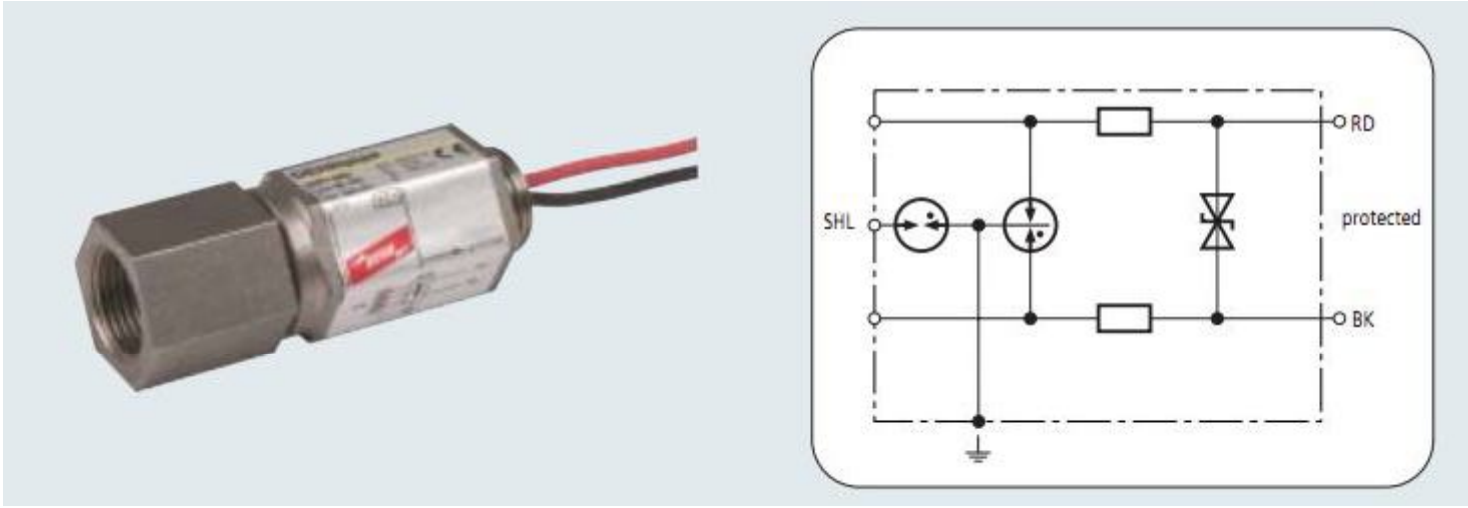


CASE STUDY- ANTAPACCAY

SURGE PROTECTION IN FIELD INSTRUMENTS

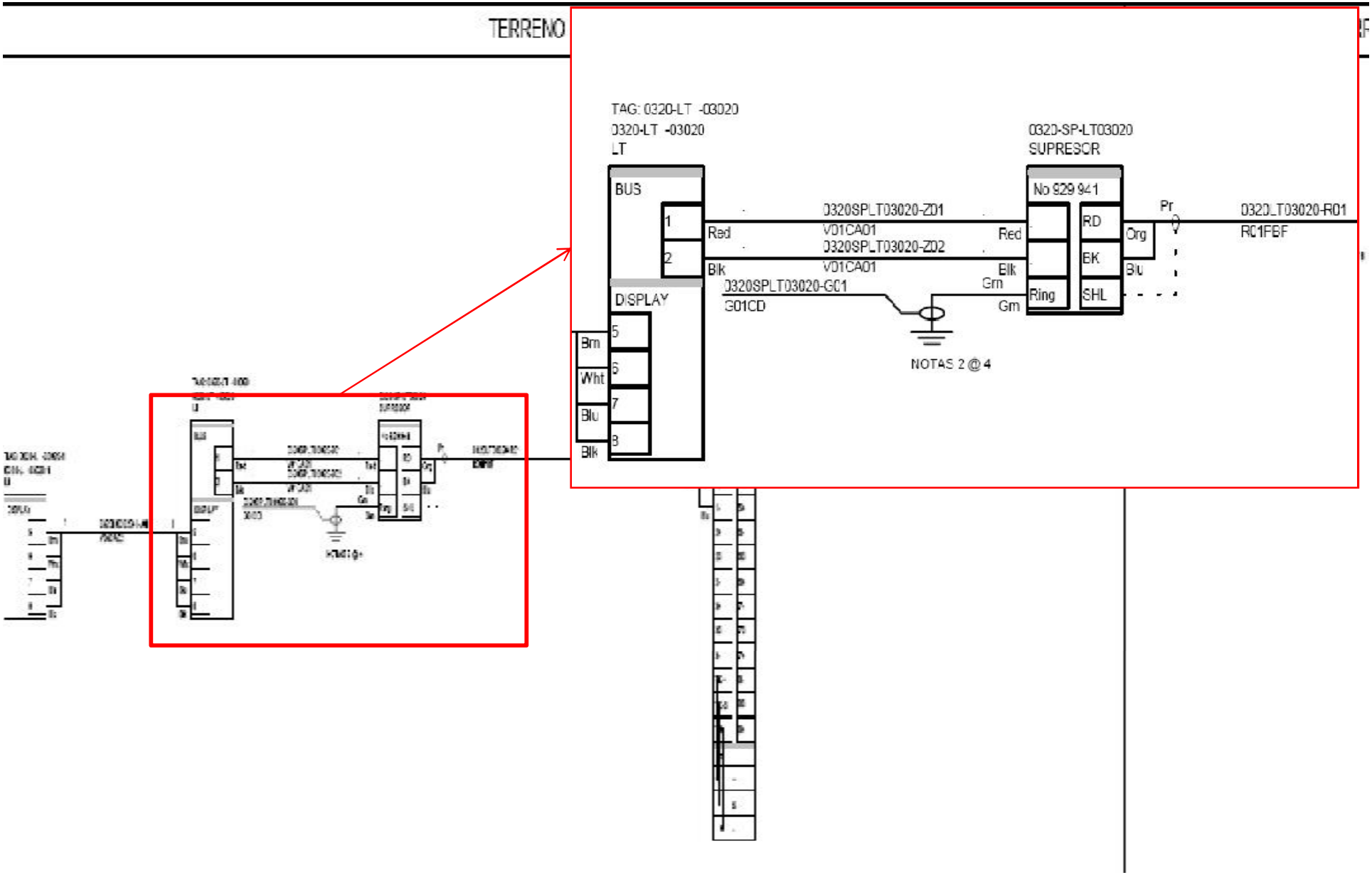
Based on the type of output signal of instrument a surge protector is selected:

- For Fieldbus/4-20 mA output- DEHN 929941



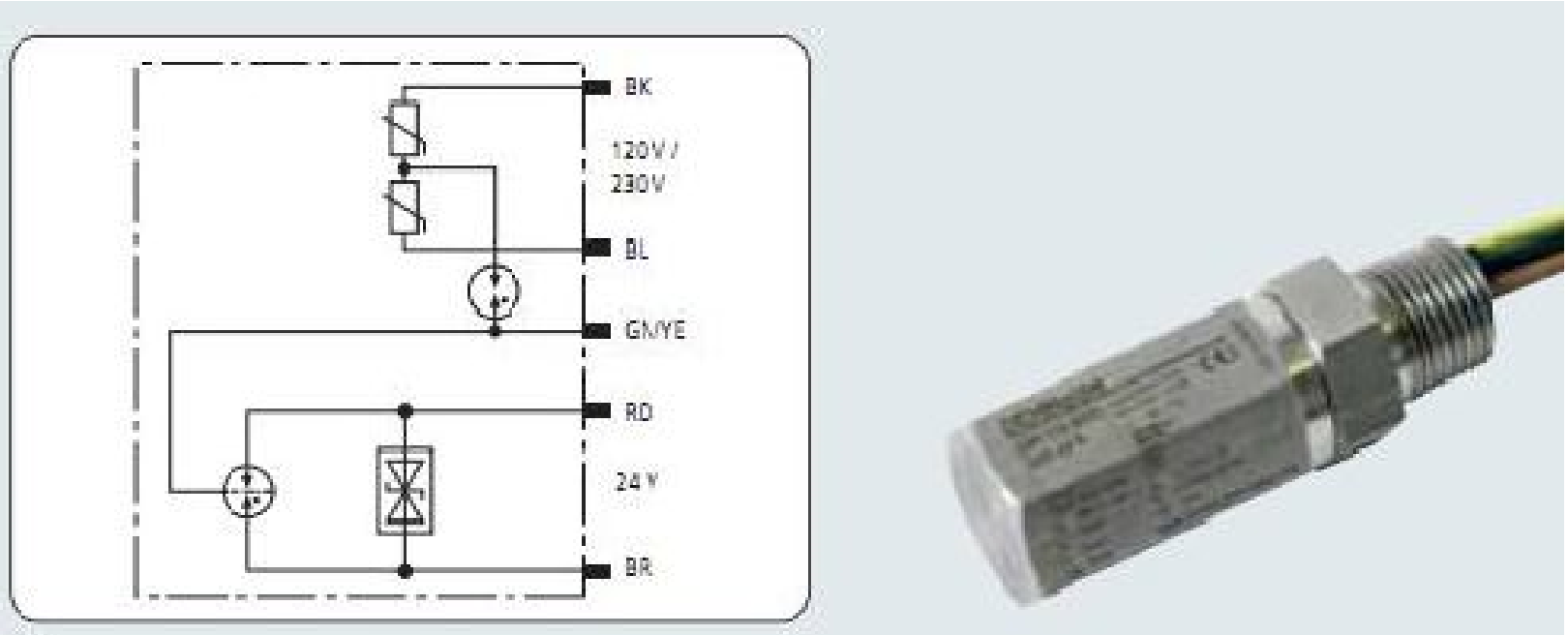
CASE STUDY- ANTAPACCAY

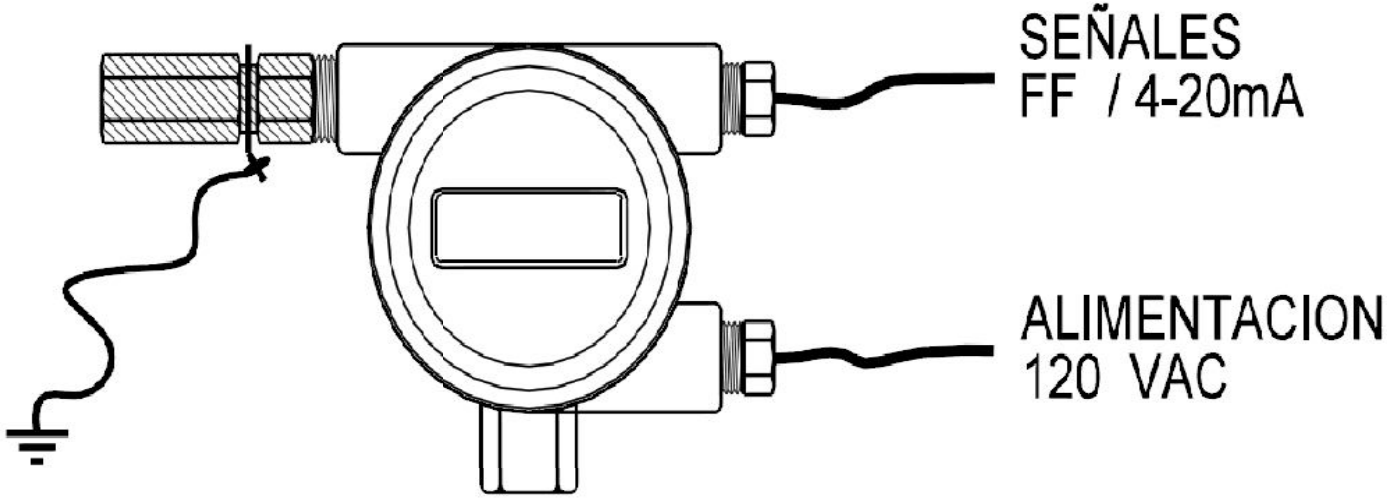
LOOP DIAGRAM OF SPD CONNECTED TO FIELDBUS INSTRUMENT



CASE STUDY- ANTAPACCAY

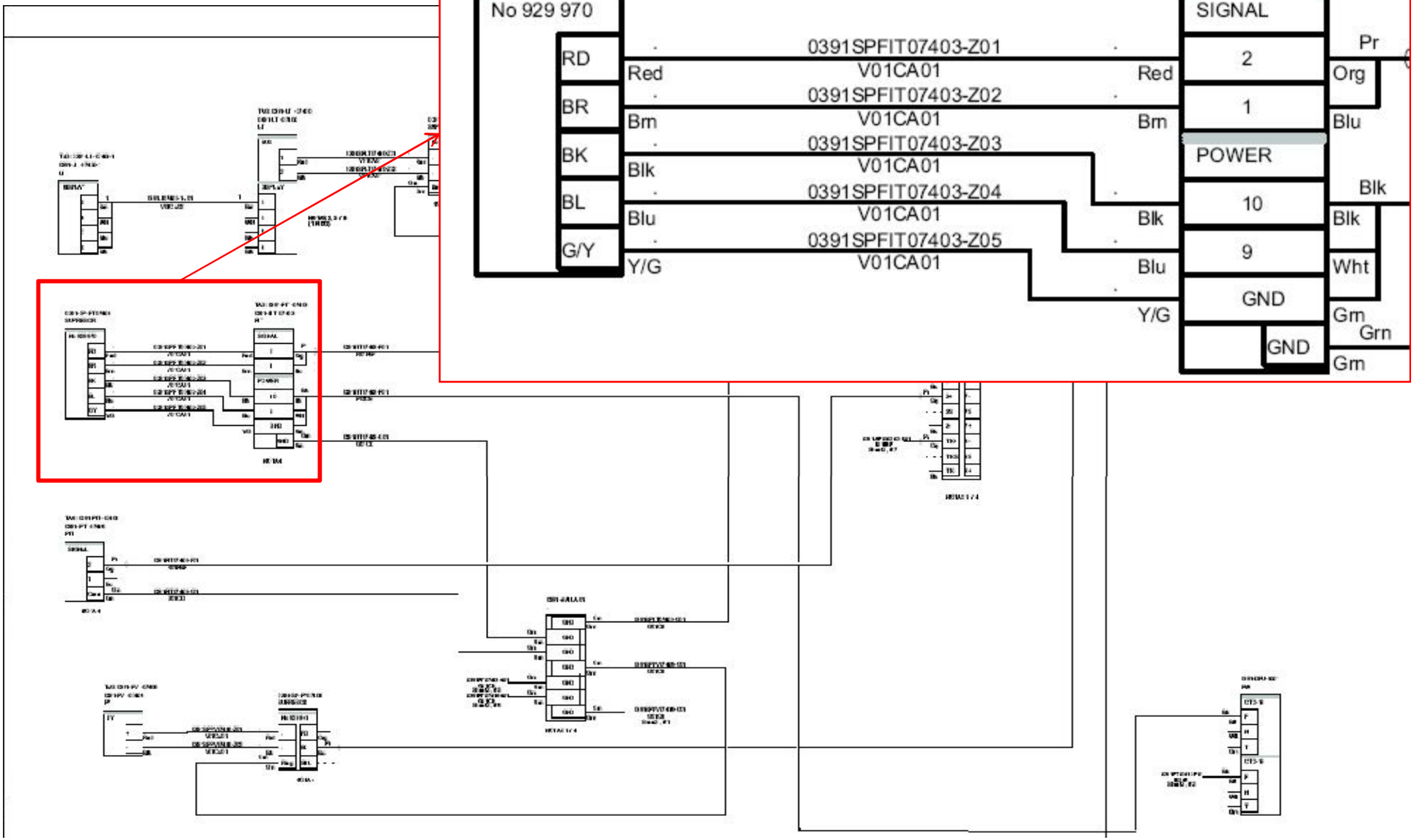
- For externally powered instrument with Fieldbus /4-20 mA output
  DEHN - 929970





CASE STUDY- ANTAPACCAY

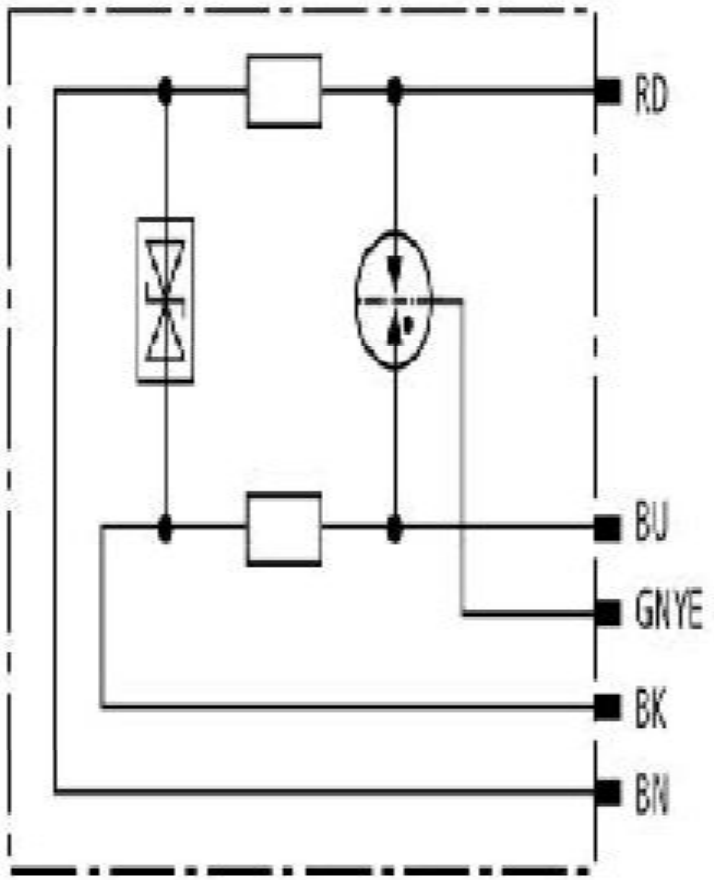
LOOP DIAGRAM FOR INSTRUMENTS



CASE STUDY- ANTAPACCAY

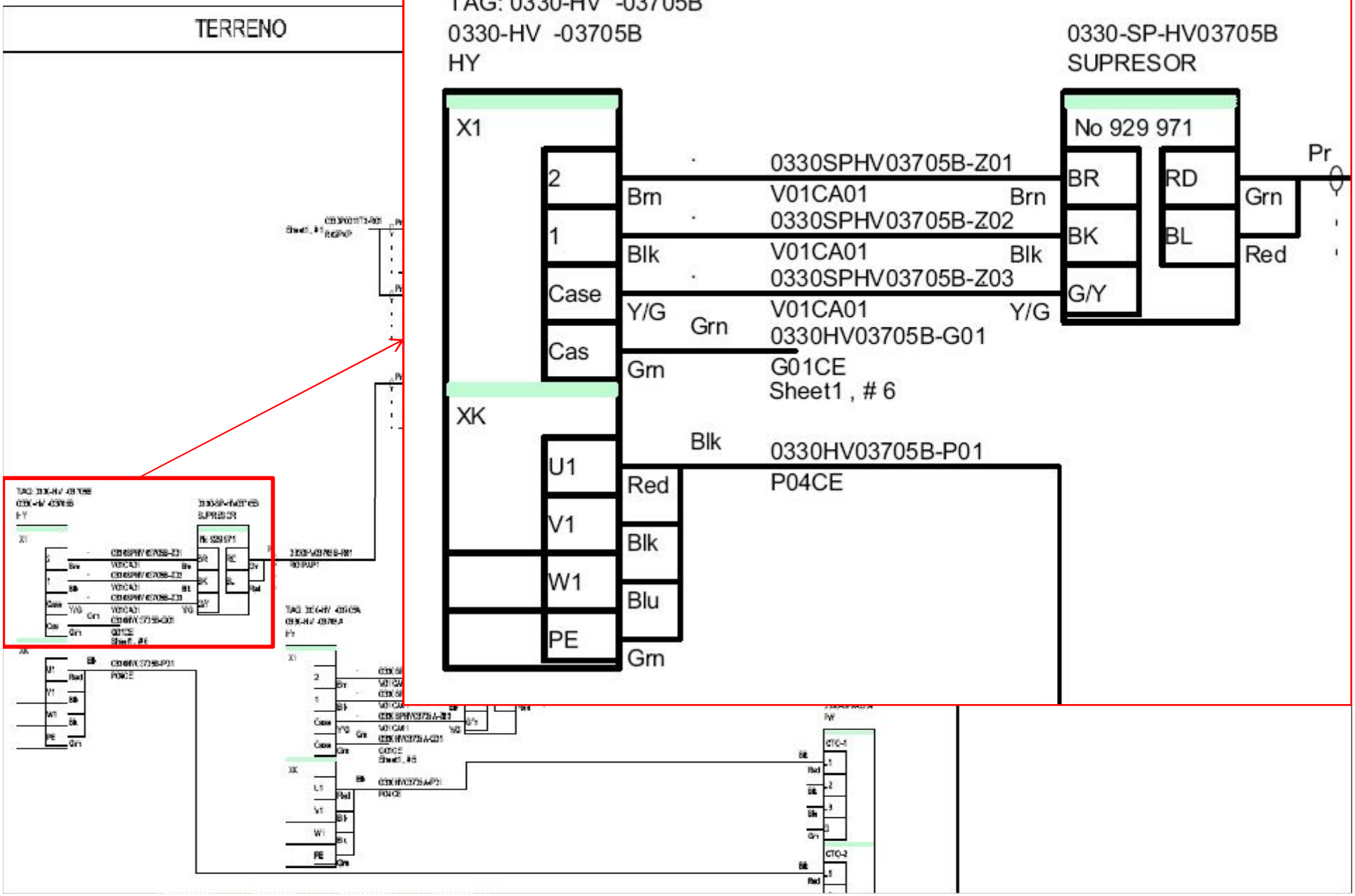
SCREWED SPD FOR PROFIBUS TYPE INSTRUMENT

Figure without obligation



CASE STUDY- ANTAPACCAY

PROFIBUS LOOP WITH SCREWED SPD



CASE STUDY- ANTAPACCAY

DIN RAIL SPD FOR PROFIBUS LOOP

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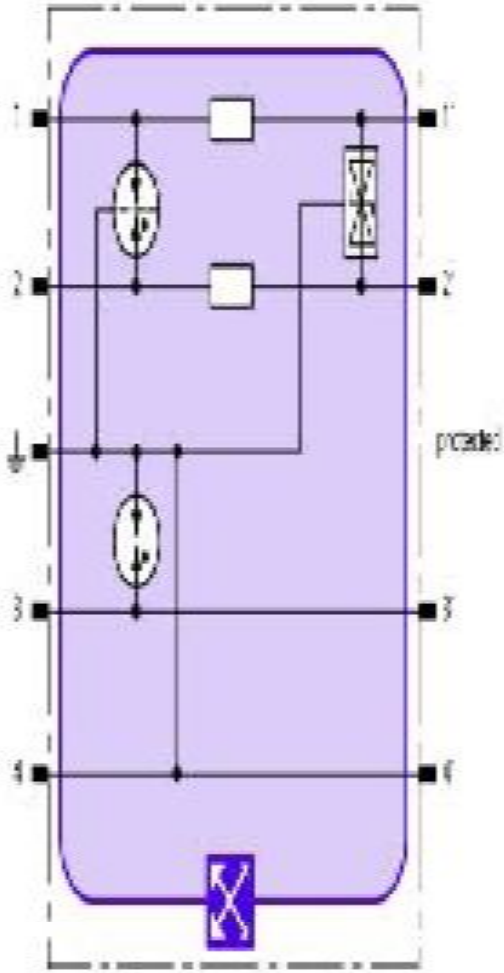
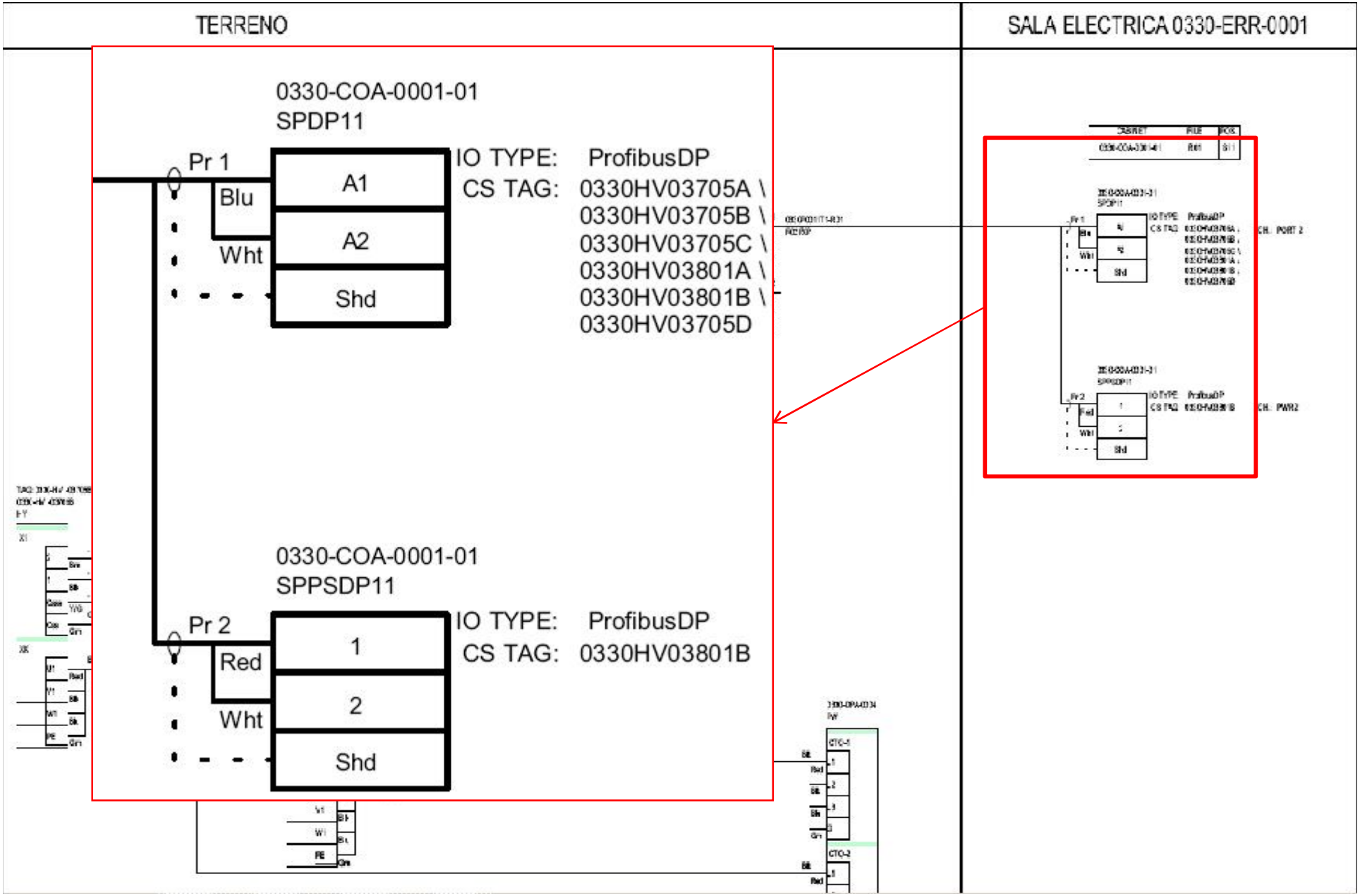


CASE STUDY- ANTAPACCAY

PROFIBUS LOOP WITH DIN RAIL TYPE SPD



CASE STUDY- ANTAPACCAY

In Antapaccay plant , a total of 647 surge protectors for field instruments were used. The numbers of various types with cost (in $) are:

Surge Protector Type	Quantity	Unit cost($)	Total cost ($)
Surge protector for foundation fieldbus transmitter	307	141.46	43429.58
Surge protector for 4-20 mA transmitter	54	141.46	7639.08
Surge protector for profibus equipment- DB9 connector	8	156.34	1250.78
Surge protector for profibus equipment- Threaded	68	149.89	10192.88
Surge protector for foundation fieldbus transmitter externally powered	123	254.55	30203.68
Surge protector for 120Vac, 60 Hz, 1 phase power supply	87	254.55	21363.58
TOTAL	**647**		**$ 114079.58**

CASE STUDY- LAS BAMBAS

- Las Bambas is a similar plant located 75 Km south of Cusco in Peru.
- It is located at an altitude of 4100m above sea level.
- This area also has a Keraunic level of 60.
- Based on the lesson learnt from Antapaccay, surge protector for all field instruments were already included in the design.
- The project is in detailed engineering phase at present.
- A total of 698 surge protectors are planned to be used in this plant. The various types with cost (in $)are :

Surge Protector Type	Quantity	Unit cost($)	Total cost ($)
Surge protector for foundation fieldbus transmitter	300	141.46	42438.00
Surge protector for 4-20 mA transmitter	88	141.46	12448.48
Surge protector for profibus equipment- Threaded	170	149.89	25481.30
Surge protector for foundation fieldbus transmitter externally powered	100	254.55	25455.00
Surge protector for 120Vac, 60 Hz, 1 phase power supply	40	254.55	10182
TOTAL	**698**		**$ 116000.78**

SURGE PROTECTION – A CASE STUDY

CONCLUSIONS

- Determination of Keraunic number or flash density data for a plant site is essential for lightning prone areas.
- Areas with Keraunic level > 60 must incorporate surge protection techniques in design for better reliability
- Incorporate Safety at Design Stage
- A typical plant with 2000 field instruments can be protected from lightning with an expenditure of less than INR 20 Million.

SURGE PROTECTION – A CASE STUDY

RECOMMENDATIONS

- Northern region of Jammu Kashmir , north eastern region specifically Assam, eastern coast of Orissa and West Bengal have high Flash Density. Oil and Gas and other industries in such regions should incorporate surge protection for field instrument.
- Plants in above mentioned areas have been running for a long time without any damage due to lightning, however hazards of lightning surges in reduction of MTBF of field instruments should not be ignored.
- Flash Density data is not available for above areas . More studies should be conducted to establish reliable Flash Density data.
- Operating Companies should prepare a comprehensive lightning hazard report of plant site to assess the hazards of lightning and lightning induced surges.
- SPD vendors should increase awareness about the importance of surge protection.

WELCOME TO PNID 2012

Lightning & Surge Protection for

OIL & GAS

Ashish Manchanda
Phoenix Contact

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Surge & Lightning Protection Solution

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Surge Protection Solution - Concept

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EFFECT OF LIGHTNING

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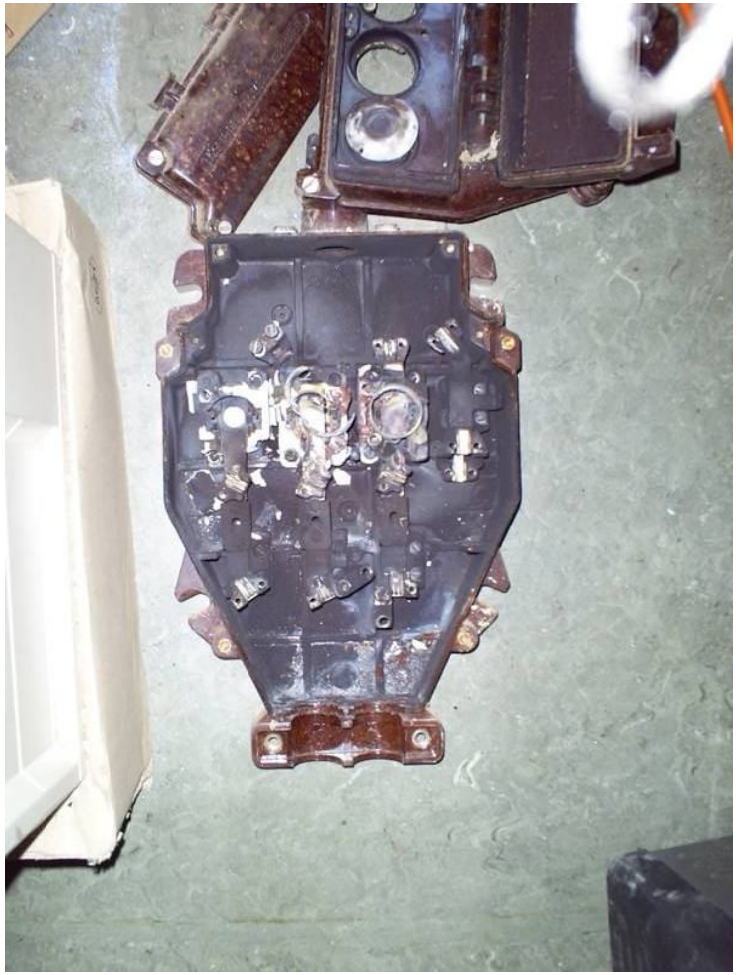
Why Surge Protection??

Service entrance



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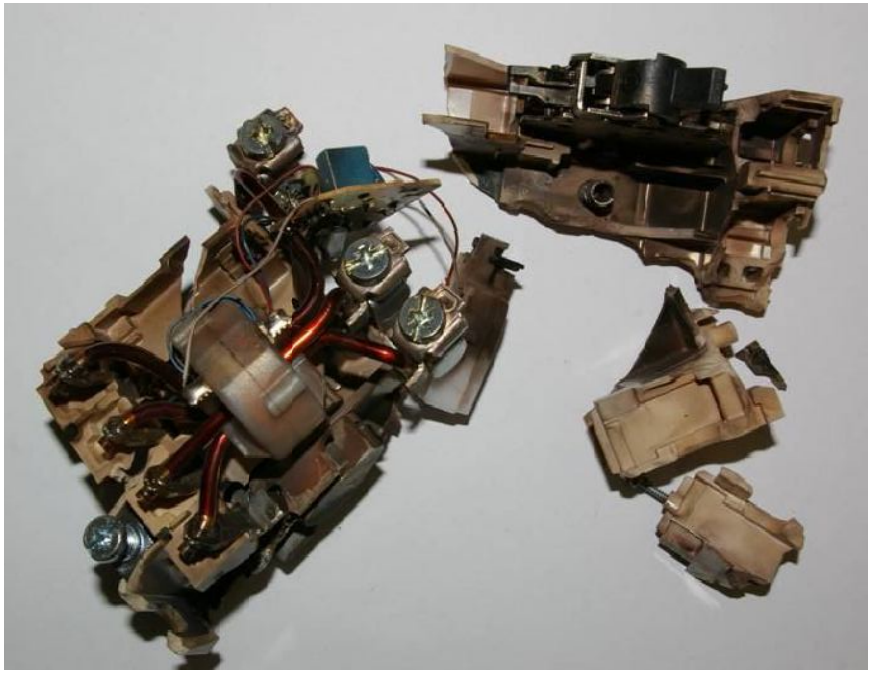
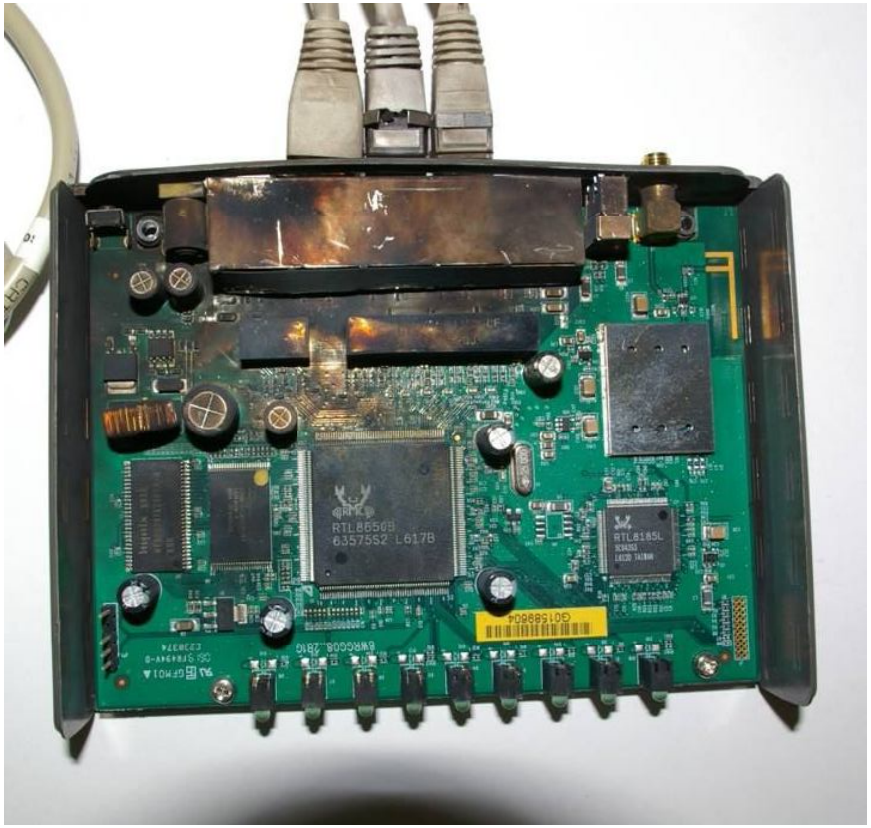
Main Distribution Panel

Residual Current Device (RCD)



Wireless LAN Router



Private Branch Exchange (PBX)

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