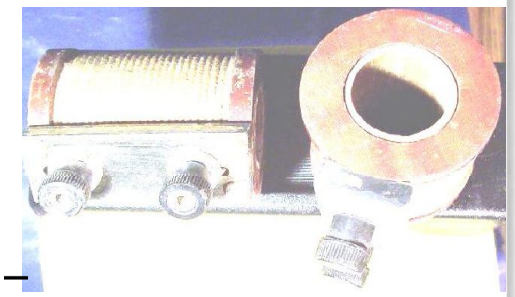
Many QUESTIONS for a Switching Interface in Control Cabinets

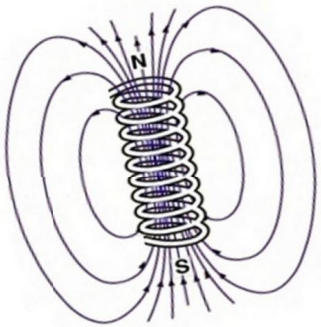


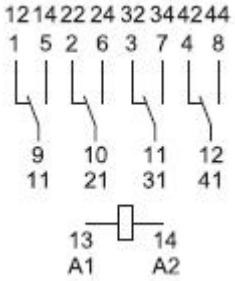
Is Coil Voltage, Changeover Contact, Contact Voltage, Contact Current ..... Sufficient to define a relay ?

A RELAY is a considered to be a simple device that switches – Is it really so SIMPLE or we should give it a second thought?

It could be that a same relay works for all applications, BUT for a limited time period. As every application is different, is so the relay?

Is it worth considering Relay Footprint, Approvals, Diagnostics, Switching Cycles etc.?





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THE ANSWER - Performance Parameters for a Relay Interface

TOP 10 factors that influence the performance of a switching relay interface :-

- Contact Material
- Coil Requirement
- No of poles...changeover contacts
- Type of Socket/Base
- Type of Load
- Insulation
- Temperature
- Type of Mounting
- Life Time
- Service Factor

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1. Selection of Contact Material in a relay Interface

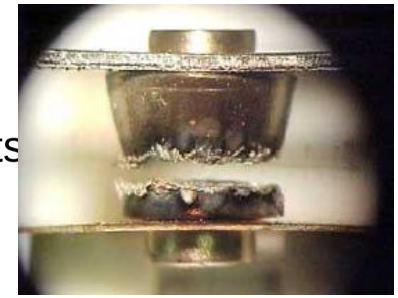
It is verified by practice that about 70% of the relay faults are because of the wrong contact material selected

The correct contact material is like the correct tires for a race car, Rally tires on a F1 car are not so good. The same is for relays, the wrong material will have a big effect on its overall performance.

There is no universal contact which covers all applications. Therefore the contacts are choosen considering:

- Resistance to arc erosion, welding or electrical sticking for Inductive, Capacitive loads
- Resistance to material migration (DC applications)
- High electrical conductivity for low resistance loads etc...

PIC: Relay Contacts showing the effects of severe over current



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Contact Material for the correct application

Contact Materials, and why they work

- **AgNi** (Silver Nickel) (Not Agni, अग्नि)
  - It is a good standard contact for most relay applications. The ratio of Rated Current Vs Inrush Current handling capability is 1:2

- **AgCdO** (Silver Cadmium Oxide) 
- It has high wear resistance and welding resistance when used with high AC loads.

- **$AgSnO_2$** (Silver Tin Oxide) 
  - It has excellent resistance to welding and is best suited for lamps and capacitive load. It has very high ratio of rated current Vs inrush current of 1:5.

AgNi+Au (Silver Nickel Gold plated) 

- It has a gold plating over AgNi of 5µm thickness and is used in applications involving small and middle load range 500mW (24V/20mA)

By selecting a wrong contact material for an application, it can destroy the contacts , one example, Contact materials can be eroded this then considerably reduces the electrical service life of the relay

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Coil Requirement

Every coil has its own target voltage and working range, right relay for right application depends purely on the operating range of the coil.

The relay contacts might work correctly over the working range as specified by the manufacturer but proper attention shall be paid for selecting the coil.

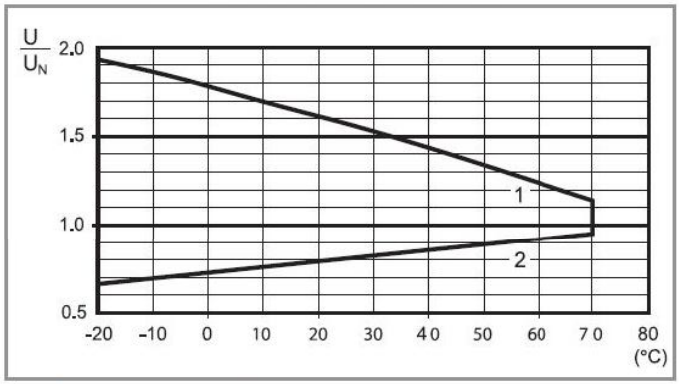
Different manufacturers specifies different coil voltage ranges, usually, for example, a typical 24V DC relay has a working range of 0.80 to 1.1 times the nominal voltage U_N.

Operating range	AC	$(0.8...1.1)U_N$	$(0.8...1.1)U_N$
	DC	$(0.8...1.1)U_N$	$(0.8...1.1)U_N$
Holding voltage	AC/DC	$0.8\ U_N/0.5\ U_N$	$0.8\ U_N/0.5\ U_N$
Must drop-out voltage	AC/DC	$0.2\ U_N/0.1\ U_N$	$0.2\ U_N/0.1\ U_N$

Coil Requirements.....contd.

An automation engineer should also give emphasis to the minimum pick-up voltage and the maximum permitted coil voltage with consideration to the ambient temperature.

R 60 - DC coil operating range v ambient temperature



1 - Max. permitted coil voltage.
2 - Min. pick-up voltage with coil at ambient temperature.

Also to be considered in some circuits leakage current or **Transient EMF interference** might be enough to keep some coils energized, therefore not releasing in the intended way , **this is where leakage suppression technology with the relay coils is useful**.

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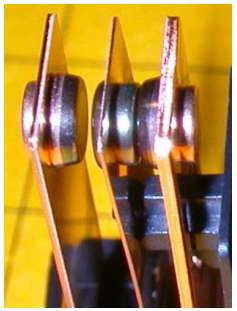
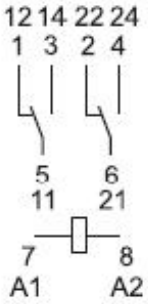
3. Selecting the Number of Switching Poles

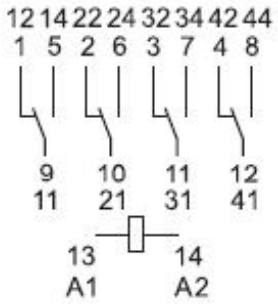
As relays come in different configuration (typically 1,2,3,4 poles) a control system designer may have to choose the number of contacts required for the application.

- Do we really need the CO (Changeover) Contact or NO (Normally Open) Contact is enough ?
- Is nPST (no. of Poles Single Throw) sufficient or do we need the nPDT (no. of Pole Double Throw) for interlocking design
- Is there a need for contact multiplication ?

Based on the above parameters the Control Cabinet Footprint can be improved drastically and space requirement as well as power consumption can be optimized.







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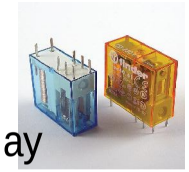
4. How to choose the correct Base / Socket for your relays

“A relay can get as good as its Base/Socket only”



Base / Socket can be one of the most important and usually overlooked parts of a relay used in a control cabinet.

The important bit is the quality of metal and plastic. The plastics need to withstand the heat generated from the contacts both in the relay, and the contact made between the socket terminal and the relay terminal. And the metal (must be non-ferrous) needs to have enough elastic force to maintain its grip or pressure on the relay terminals.

Usually this is where improper bases/sockets fails as, the clamps in the base open up with heat and fails to return to its original position, and this reduces the contact pressure, increases heat and an undetectable failure occurs in the control system.

In all cases the relays and the bases/sockets should be made by the same manufacturer as per the specific mating requirements and approvals.

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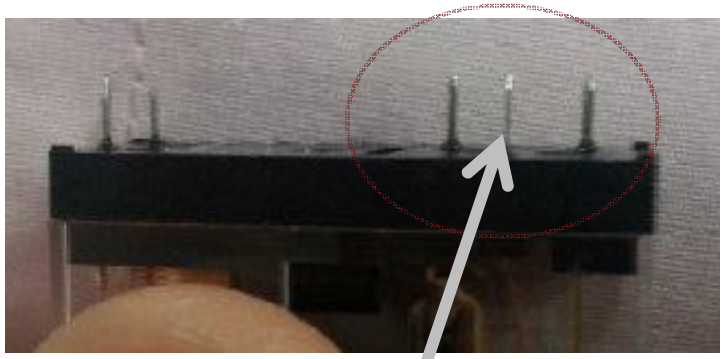
Base / Socket selection…….cont’

The secret to a good electrical connection is the result of Area x Pressure. If a joint is made up with too little pressure, moisture and air will penetrate the joint an promote corrosion which raises resistance which increases heating which can accelerate corrosion



Assume this random relay Socket manufacturer has not considered, that the relays pins in the attached relay example, are of different thicknesses (center COM pin <0.5mm) therefore it has different clamping forces, or different load carrying abilities on different pins.
The Socket and relay **must** to be **matched** for correct operation.

At the very least, we must ensure **all the Relay pins are of the same thickness**, and are **minimum of 5mm long** to ensure a secure connection between the relay Pins with the socket.

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5. Selecting Relay as per types of loads in application

Type of Loads

- Loads can be of different types example- Resistive, Inductive, Capacitive, Lamp Load, Motor Load etc. Some loads like Motor and **Inductive loads have high inrush current and can damage the contacts of relay if not selected properly**.

- **An additional protective circuit should be installed to overcome the ill effects of the using DC inductive loads and to increase the service life of the relay and the controller**.

- For both small AC and DC loads especially for control signal applications, There is no electrical cleaning action(arc), which can remove a normally forming oxide layer built over the contacts, without this action reliable signal switching becomes impossible for small loads. **Thus Gold plated contacts are preferred universally for small loads due to its ability to stop the oxidation process**

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Contact Load Classifications – EN 60947

Relays must be Rated and selected in accordance with the established international standards. Non-standard ratings will not guaranty the stipulated Electrical Life of the relay. User must have the information on the life of the relay for the different classifications of Loads as given below;

- AC 1– Resistive or Slightly Inductive AC Loads
- AC 3 – AC Motor Loads
- AC 14 – AC Power Contactors, Magnetic Solenoid Valves etc with peak inrush current of 6 times the nominal rating
- AC 15 – Same as AC 14 but with peak inrush current of 10 times the nominal rating
- DC 1 – Resistive or slightly inductive DC Loads
- DC 13 – DC Power Contactors, Magnetic Solenoid Valves etc with break off voltage of up to 15 times the nominal voltage rating

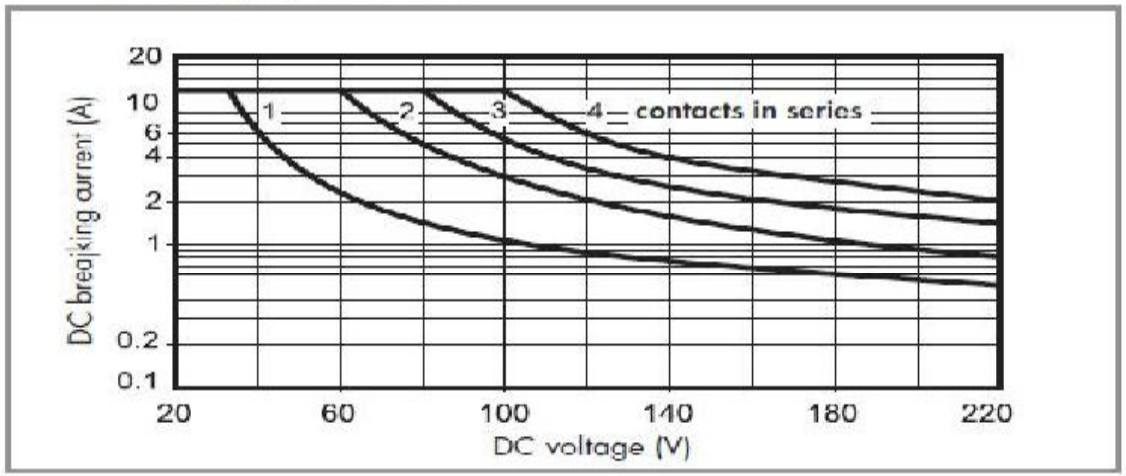
Type of Load ….contd.

A basic separation in the relays should be maintained between AC and DC Loads.

When switching large AC loads, the relay can be operated up to the mentioned voltage and current levels as the arc produced during the switching goes out in the next zero phase of AC cycle.

However with switching DC loads, due to non availability of Zero Crossing to extinguish the arc automatically, the relay can only switch relatively small DC loads. In industrial applications demanding switching high DC loads, a user has an option to connect two contacts(or more) in series to increase the switching capacity like the example below

H 56 - Maximum DC1 breaking capacity
Normally open version



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6. Relay Insulation

Insulation in accordance with EN 61810-1

The main functions of a relay is to connect and disconnect different electric circuits, and usually, to maintain a high level of electrical separation between different circuits. It is therefore necessary to consider the level of isolation appropriate to the application and the task to be performed - and to relate this to the relay's specification.

Below is an example of the most up to date relay insulation standards, and supersedes older relay insulation standards

Insulation according to EN 61810-1		2 CO - 4 CO		2 NO - 4 NO	
Nominal voltage of supply system	V AC	230/400		230/400	
Rated insulation voltage	V AC	250	400	250	400
Pollution degree		3	2	3	2
Insulation between coil and contact set					
Type of insulation		Basic		Basic	
Overvoltage category		III		III	
Rated impulse voltage	kV (1.2/50 µs)	4		4	
Dielectric strength	V AC	2,500		2,500	
Insulation between adjacent contacts					
Type of insulation		Basic		Basic	
Overvoltage category		III		III	
Rated impulse voltage	kV (1.2/50 µs)	4		4	
Dielectric strength	V AC	2,500		2,500	
Insulation between open contacts					
Type of disconnection		Micro-disconnection		Full-disconnection*	
Overvoltage category		—		II	
Rated impulse voltage	kV (1.2/50 µs)	—		2.5	
Dielectric strength	V AC/(1.2/50 µs)	1,000/1.5		2,000/3	

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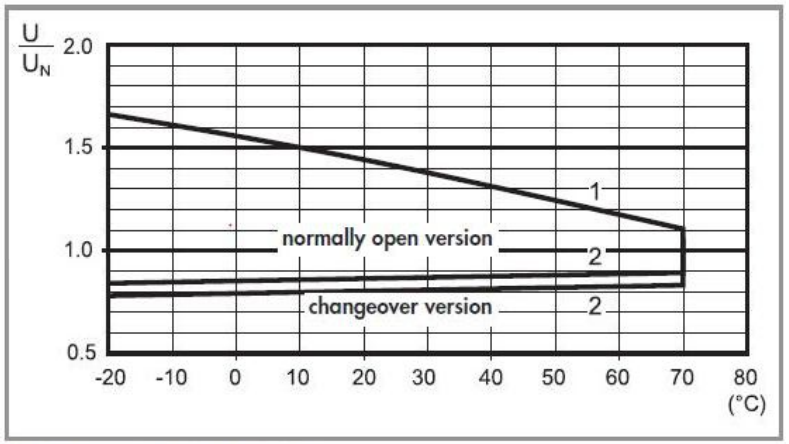
7. Considering the Relay's Temperature ratings

Temperature plays an important role in selecting a relay. The relay exposed to harsh ambient temperatures would lead it to work unreliably. While designing the system it is therefore necessary to take temperature as the main criteria. A typical Coil Voltage variation graph with respect to temperature is shown below.

R 56 - AC coil operating range v ambient temperature
4 pole relay or 4 NO



1 - Max. permitted coil voltage.
2 - Min. pick-up voltage with coil at ambient temperature.

Using Thermosetting plastics are the newest technology for relays, holding contacts and coils in a more secure and with a better resistance to higher temperatures and possible internal movement.

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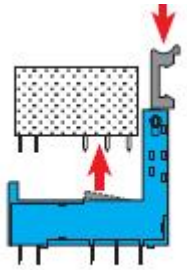
8. Relay mounting for a Control Cabinet application

Type of Mounting

Today depending on the application type, a user has different options for mounting the relay. The most common being the PCB version. These types of relays can mounted on a PCB with a relevant socket soldered on it.



In industries however Socket/Base mounted relays are preferred because of their modularity and ability to mount on DIN rails or screw mounting on panels.

Third type of mounting is Flange mounting, which is used if there is no DIN Rail available

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9. Life Time of a Relay for your application

Life Time

For a reliable switching interface, the components both electronic and electro-mechanical, installed within it should also have a high reliability factor.

The Life Time of a Relay must be specified along with the Rated Current, by a manufacturer for all type of Loads, so that the design engineer can optimally select the relay that can perform the required no. of switching cycles as per the application.

A typical rating example of Mechanical and Electrical Life of a relay is given as under

Technical data				
Mechanical life AC/DC	cycles	—/20 · 10^6	—/20 · 10^6	—/20 · 10^6
Electrical life at rated load AC1	cycles	200 · 10^3	50 · 10^3	200 · 10^3

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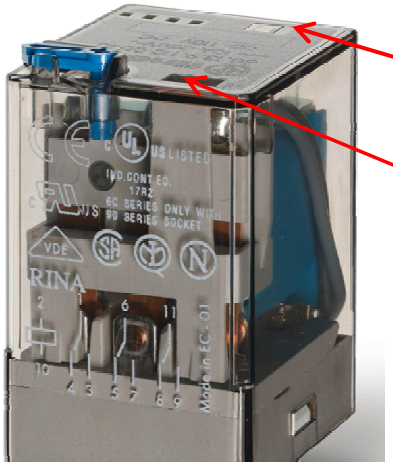
10. Service aspects of a Relay

Service is now a very important Factor of relay technology

Diagnostics:

The users have a need to detect the Electrical as well as Mechanical faults on a relay. It is thus very useful to adopt a technology that has built-in indication for both - the Coil Actuation via LED as well as the Contact Latching via Mechanical Flag, such that the user can identify the nature of the fault.



Replaceability:

After the fault is diagnosed, the user needs an easy identification of the key technical parameters of the relay, so that the correct replacement can be ensured without looking at extensive documentation. For this purpose, it is important that the technical parameters are Laser printed on the relay, as ink printing normally wipes out over a period of time.

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10. Serviceability .....contd.

Service is now a very important Factor of relay technology

Upgradability:

Based on the experiences of the end users there may be a need to add-on certain additional functions on to the relays under use i.e. additional protection of Varistors, Filter Circuits, Free Wheeling Diodes, Fuses, Indications, Timers functionalities etc at a later stage. The accessories based on “plug-in” technology is now available to carry out such functional upgrades in the relays without having the need for any rewiring or breaks in the process control.

Timer Module

Diode / Varistor / LED

Replacable fuse

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SUMMARY of Point to be considered for a relay

Final points to consider,

- Relay rating as per type of Load.
- Contact material as per switching needs
- Thermosetting Plastic materials
- Base/Socket rating and approvals
- Electrical & Mechanical Diagnostics
- Long Life & Serviceability

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CONCLUSION

Reliability through RELAYability

The reliability of relays plays an important role in the availability and “uptime” of control system.

For each application therefore the best relay shall be chosen based on different technical parameters.

With the advancements in technology and the multiple options now available in the Relays, the need of the hour is a design elevation to be considered at the time of detailed engineering, to not only help in increasing reliability, reducing the cabinet footprint, removing wiring errors, preventing additional heat generation inside the cabinet, save spacing but also optimize costs directly as well as indirectly.

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Approvals: Reference standards

- The relays are designed and manufactured according to the requirements of the following European and International Standards:
  - **EN 61810-1, EN 61810-2, EN 61810-**7 for electromechanical elementary relays
  - **EN 50205** for relays with forcibly guided contacts
  - **EN 61812-1** for timers
  - **EN 60669-1** and **EN 60669-2-2** for electromechanical step relays
  - **EN 60669-1** and **EN 60669-2-1** for light-dependent relays, electronic step relays, light dimmers, staircase switches, movement detectors and monitoring relays.

Approvals: Reference standards

- Other important standards, often used as reference for specific applications, are:
  - **EN 60335-1** and **EN 60730-1** for domestic appliances
  - **EN 50178** for industrial electronic equipments

Why our relays??

- 100% Western production
- The plastic materials are in conformity to the UL94
- Bases & coils are produced in Termosetting plastic
- Coils are test 3 times during the production
- The industrial relays can be energized continuously
- 100% of the production is test before selling
- Different Contact materials are available different Contact materials for any special applications
- More than 55 years experience in relays

Questions??

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THERMAL MANAGEMENT SOLUTIONS

An Introduction

THERMAL MANAGEMENT AT A GLANCE

- **Global Facts**
  - Revenue: $800+ million
  - Presence: 40 locations (including 6 manufacturing facilities & 6 engineering centers)
  - Resources: 2,500+ employees
  - Headquarters: Houston, TX, USA

- **A portfolio of trusted brands**

Raychem · Pyrotenax · TRACER · DigiTrace · TraceTek

- **Comprised of (4) product/service categories:**
  - Industrial Heat Management Products
  - Building & Infrastructure Solutions
  - Engineered & Specialty Solutions
  - Turnkey Solutions

- **Full turnkey solutions across our product portfolio for end customer life cycle support**

A Global Leader in Heat Management Solutions

Find the leaks before they find you

Leak Detection System For Pipeline & Storage Tanks Application.

Leak Detection for pipelines

The Problem:

How can we minimize damage caused by small leaks that go unnoticed for long periods?

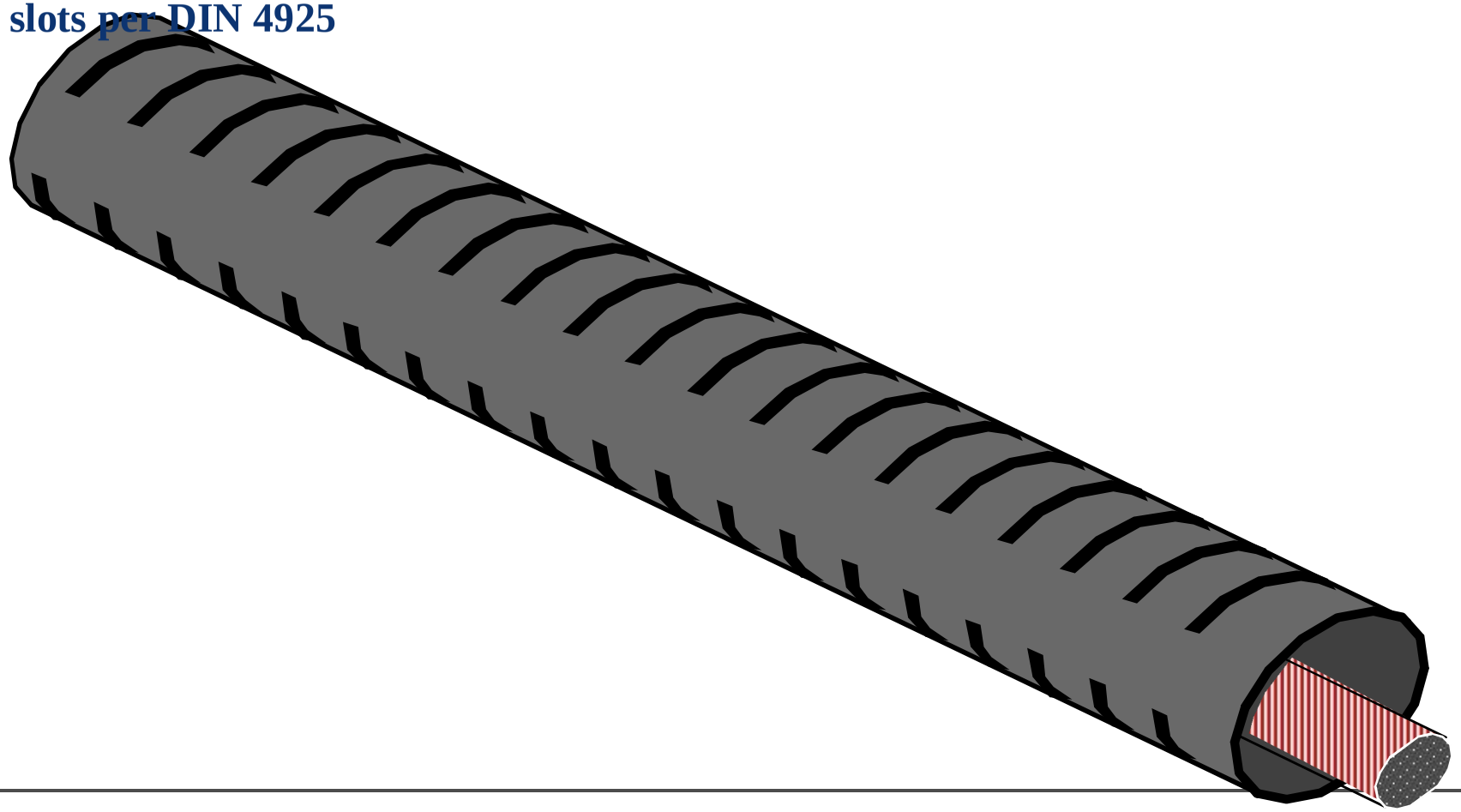
THE SOLUTION

Carbon enriched conductive polymer based technology

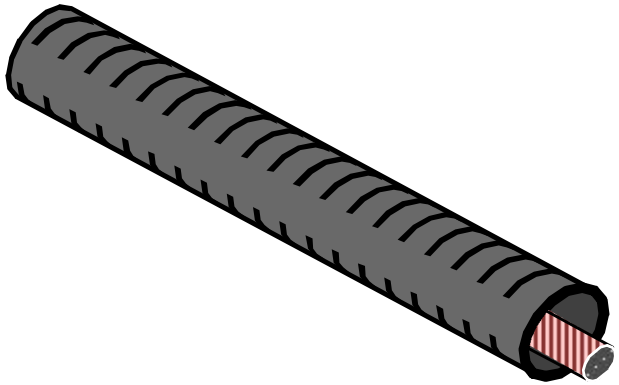
- **Real liquid hydrocarbon sensor**
- **No false alarms with rain water even dissolved hydrocarbons**
- **Suitable for all buried applications**
- **Continuous sensing**
- **Can be installed in Ex zone 0**

TT5000 Sensor in Slotted PVC Conduit

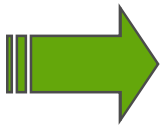
- **42 mm OD x 32 mm ID**
- **0.5 mm slots per DIN 4925**



External Direct Measurement

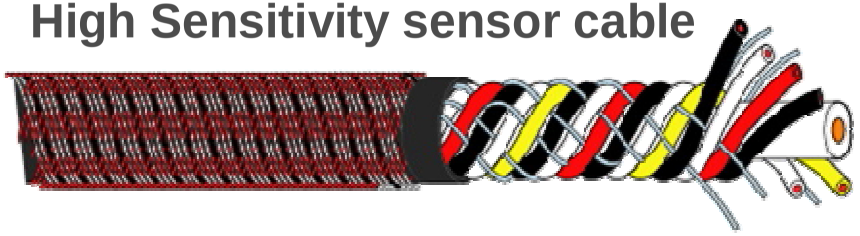


Positioned alongside the pipeline

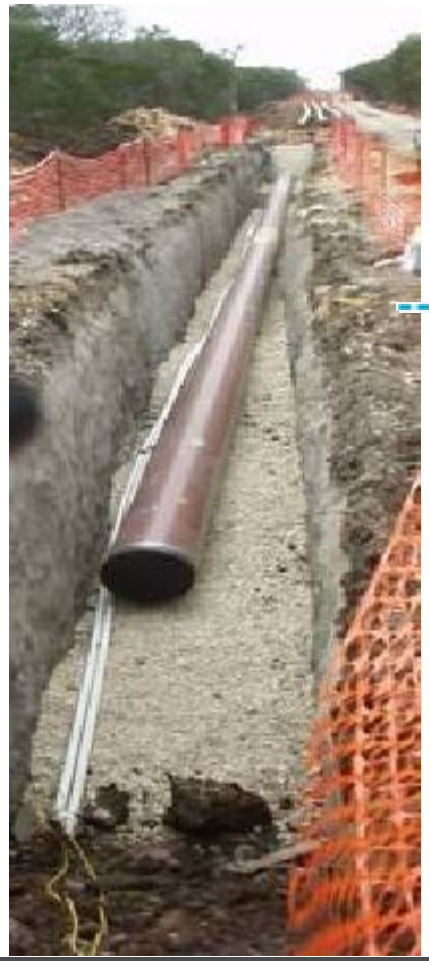


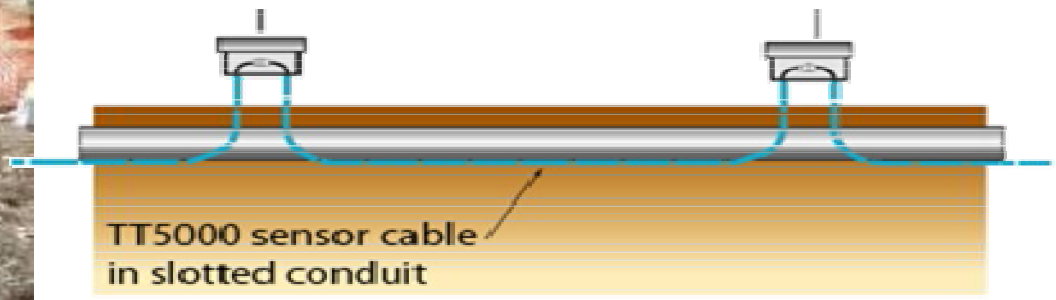
Installed into PVC well screen pipe

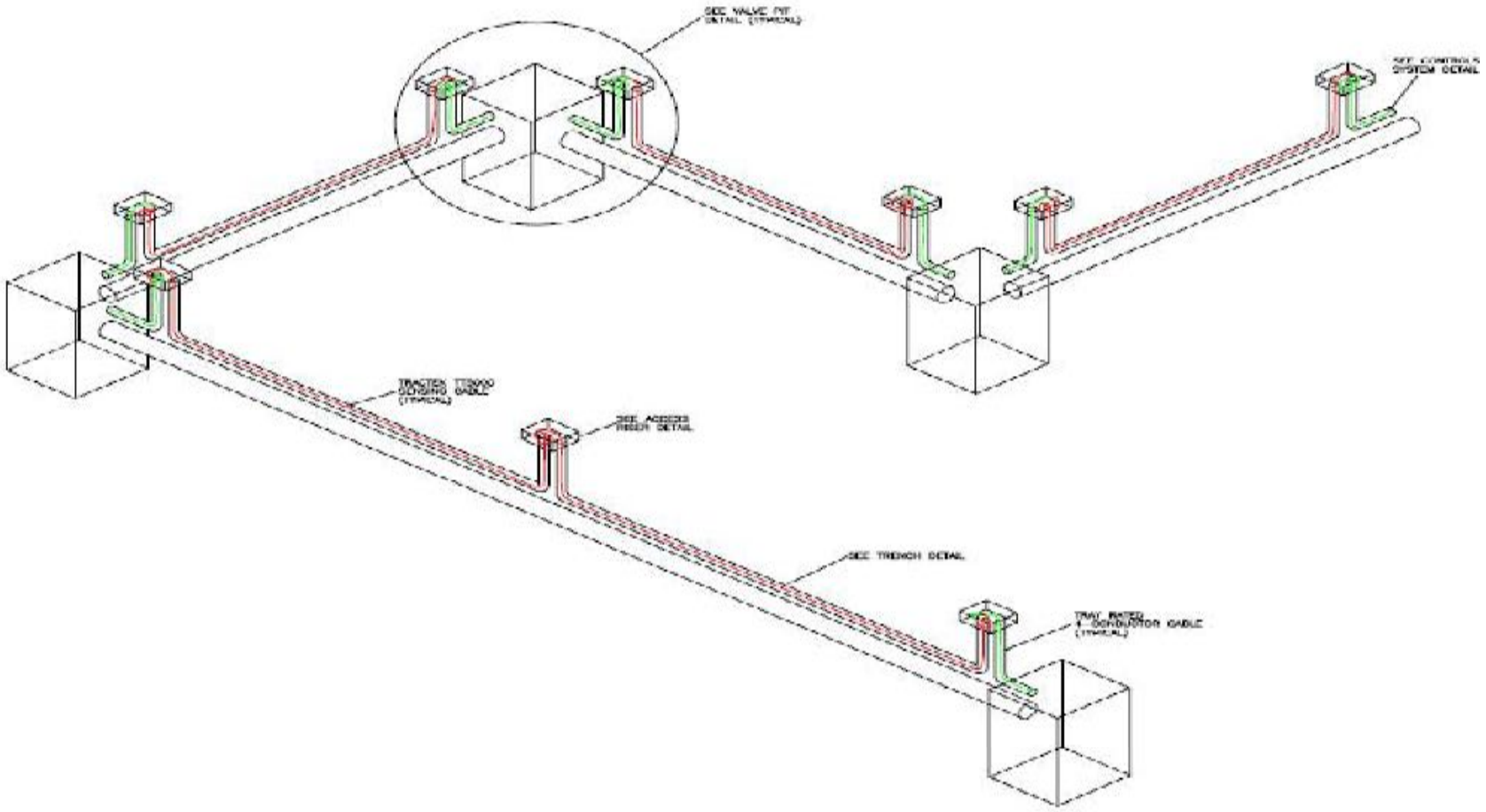
High Sensitivity sensor cable



Buried pipelines projects






SEE VALVE PIT
DETAIL (TYPICAL)
SEE ACCESS
TRENCH DETAIL
SEE TRENCH DETAIL

Slotted PVC Conduit beside 18” pipeline

External leak protection

Airport fuel hydrant systems

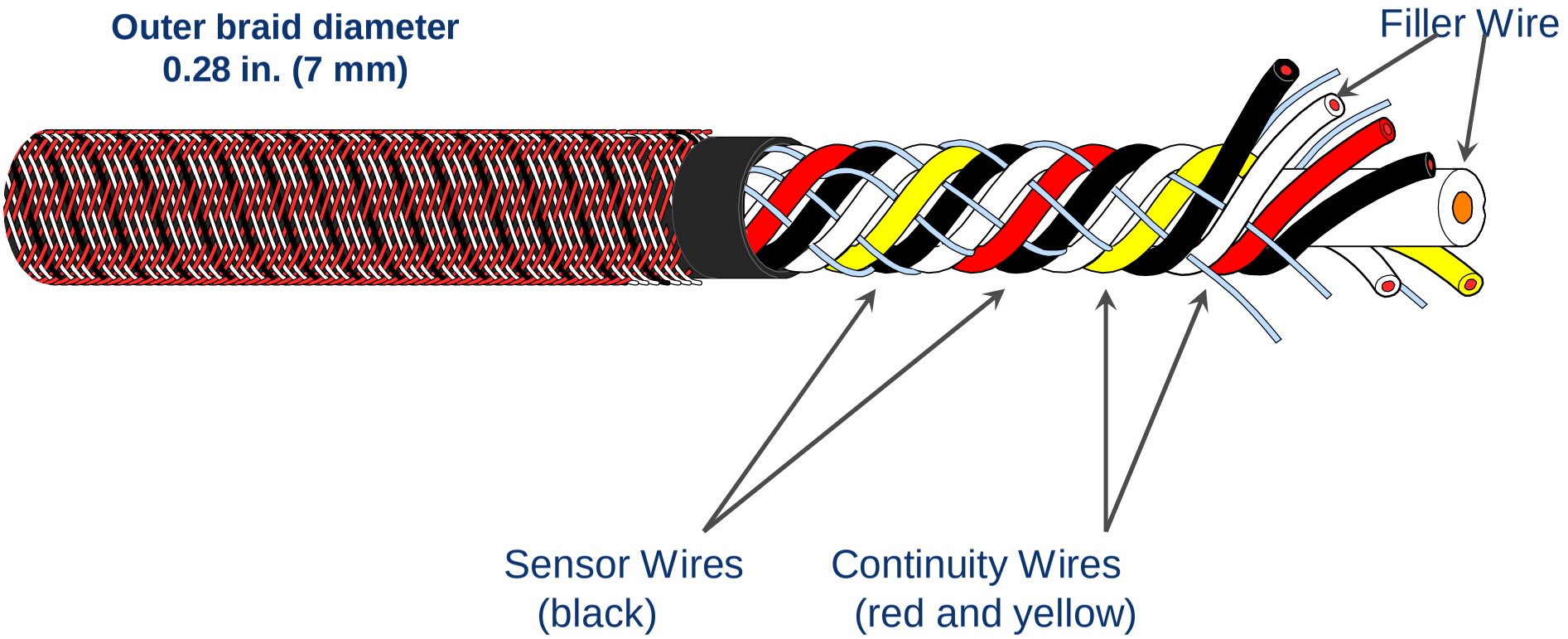
Airport Hydrant Systems

- TraceTek cable provides round-the-clock, leak detection and precise location.
- Cable is installed and serviced through access risers in the apron.
- Other airport leak detection systems are based on periodic pressure decay measurements and a given section of pipe may be tested only once every 30 days.
- TraceTek systems provide early detection and provide precise information on where to dig.
- Minimises disruptions if fuel leaks

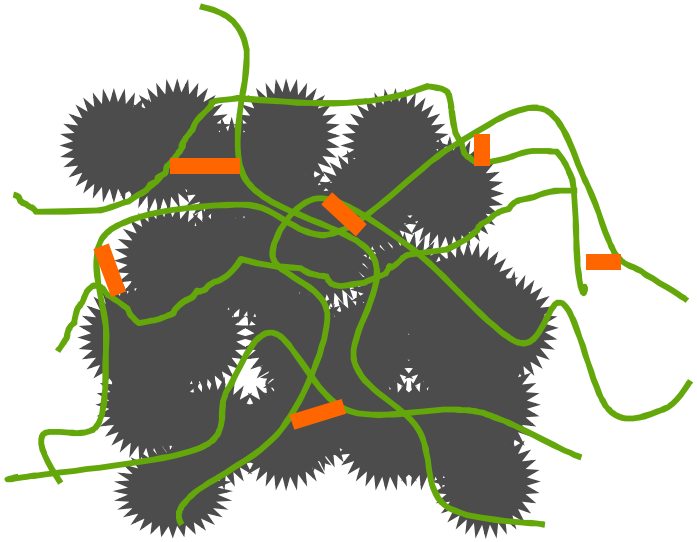
TRACETEK LEAK DETECTION SYSTEMS

Working Principle

TraceTek 5000 Series



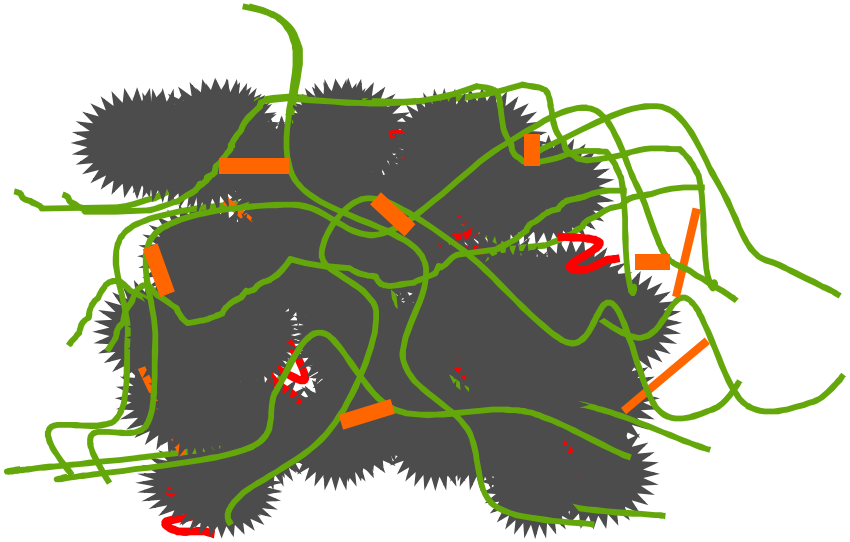
Thick Wall / Cable technology



Cable Wall Material:
PE, EPDM, Carbon
+ radiation cross linking

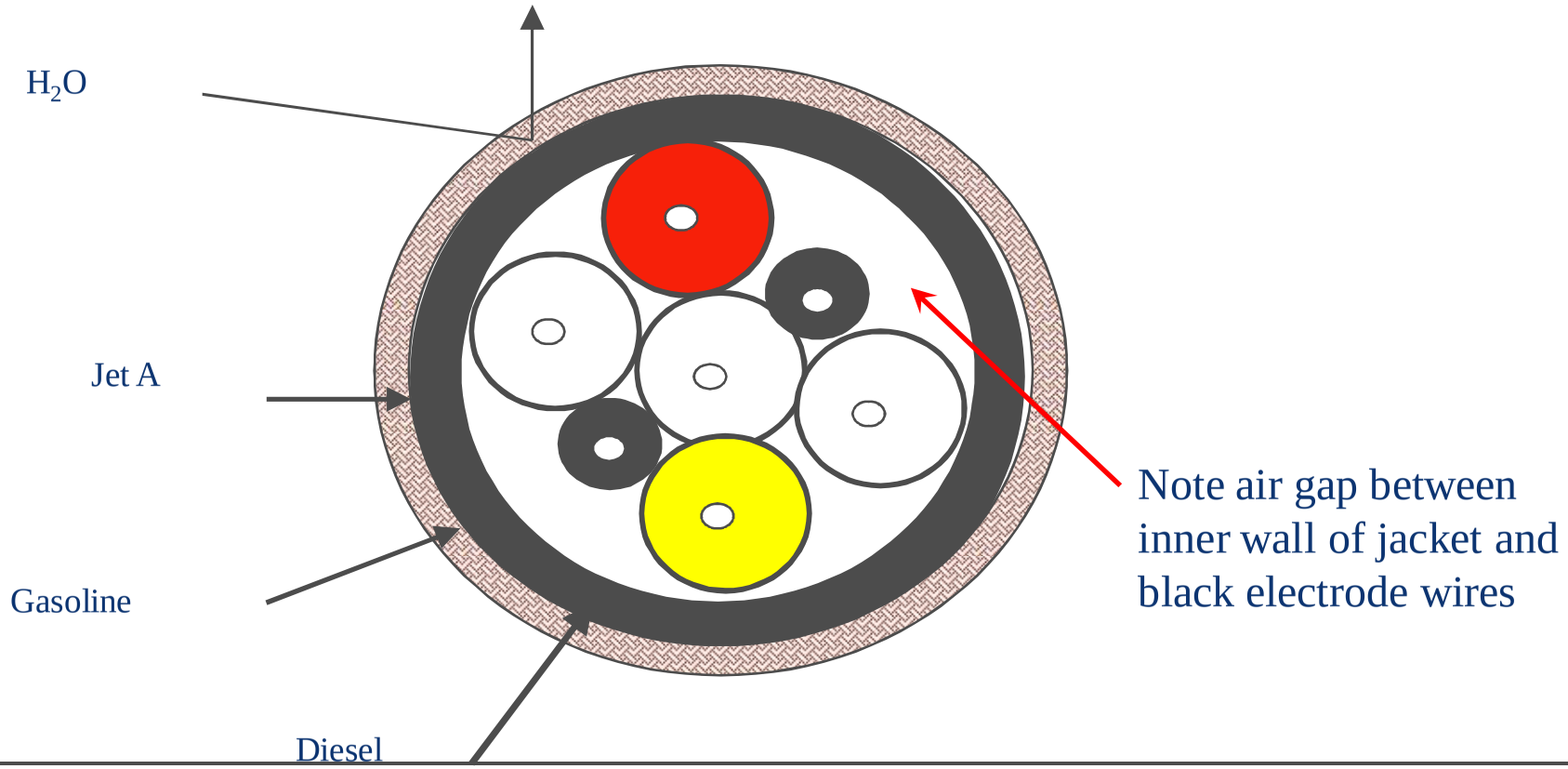
Liquid Hydrocarbons
Jet, Diesel, Gasoline,
Crude Oil, etc

Thick Wall / Cable Technology

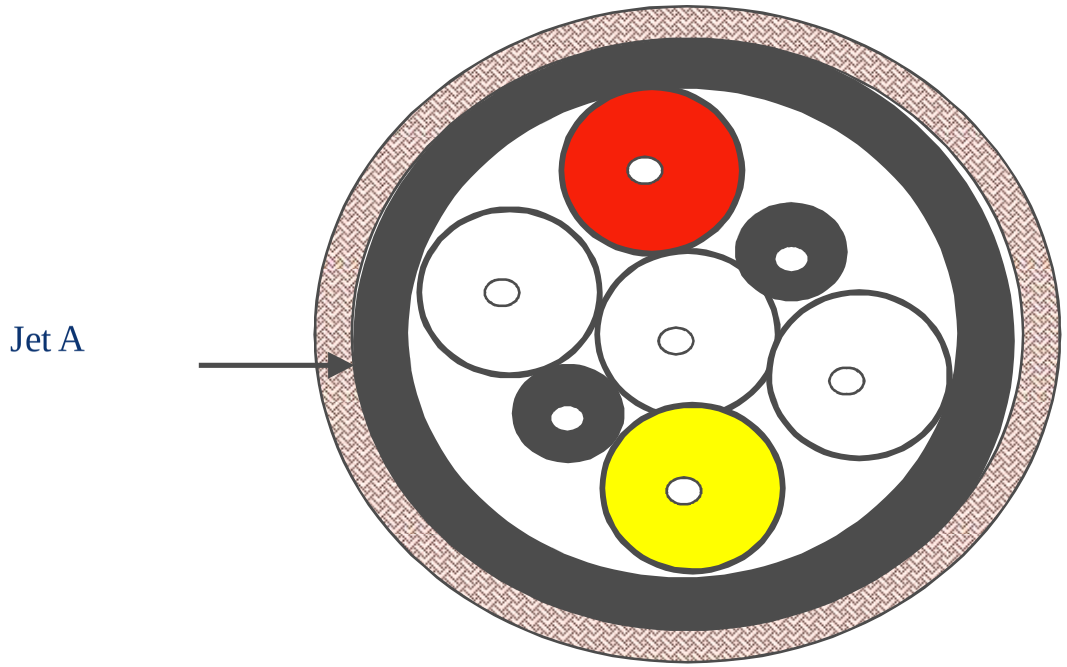


Cable Wall Material
Still conductive, but now
Volume is 200% original

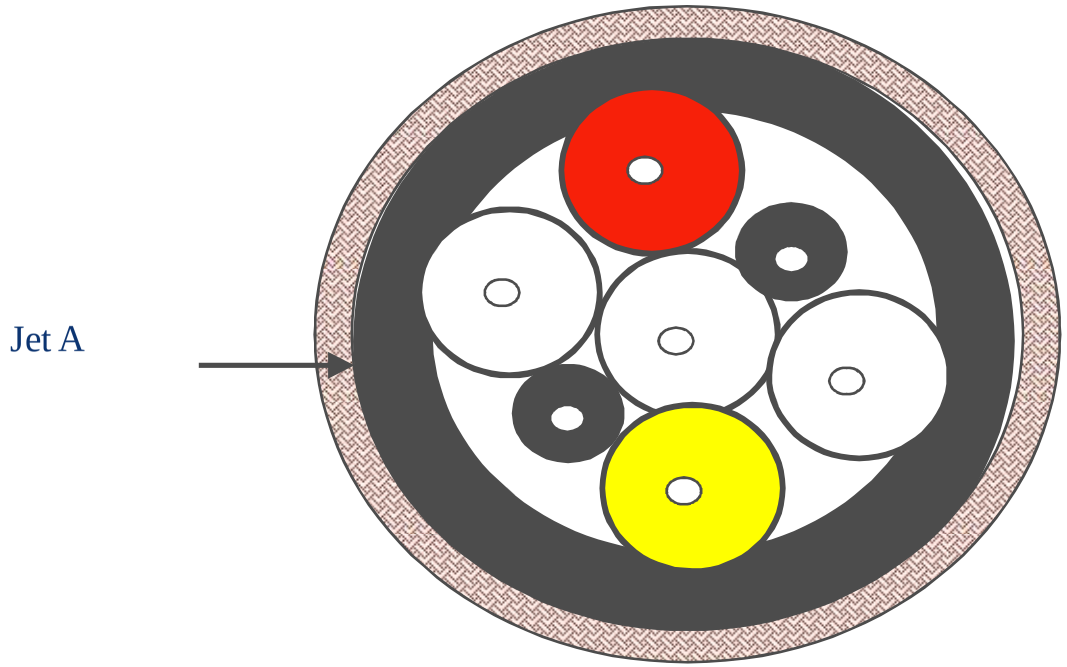
TT5000 before fuel contact



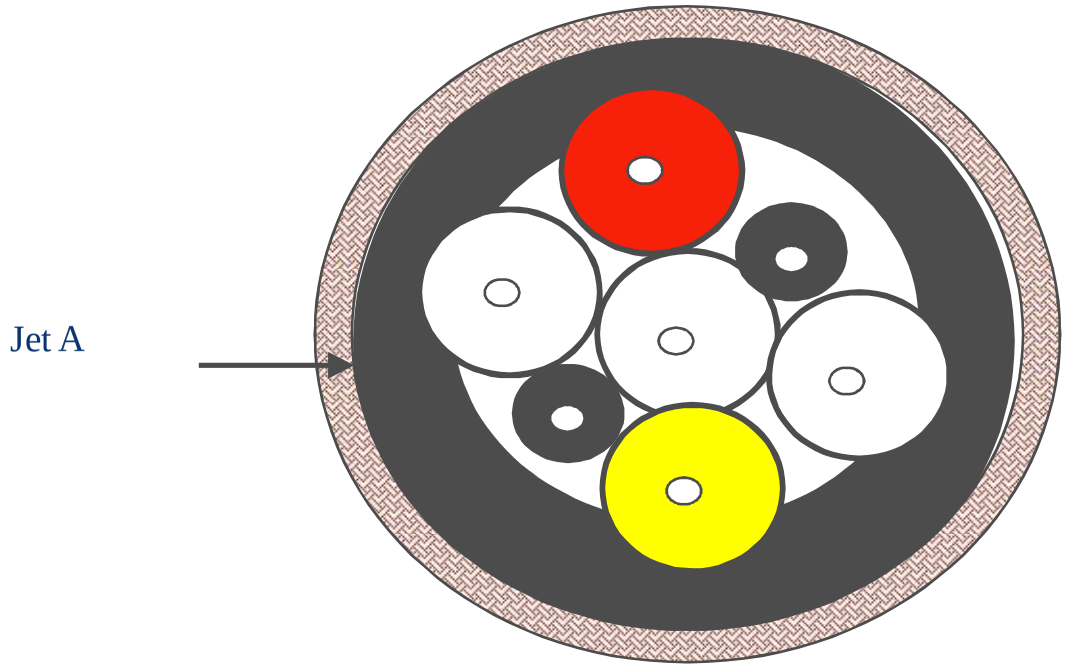
TT5000 after fuel contact



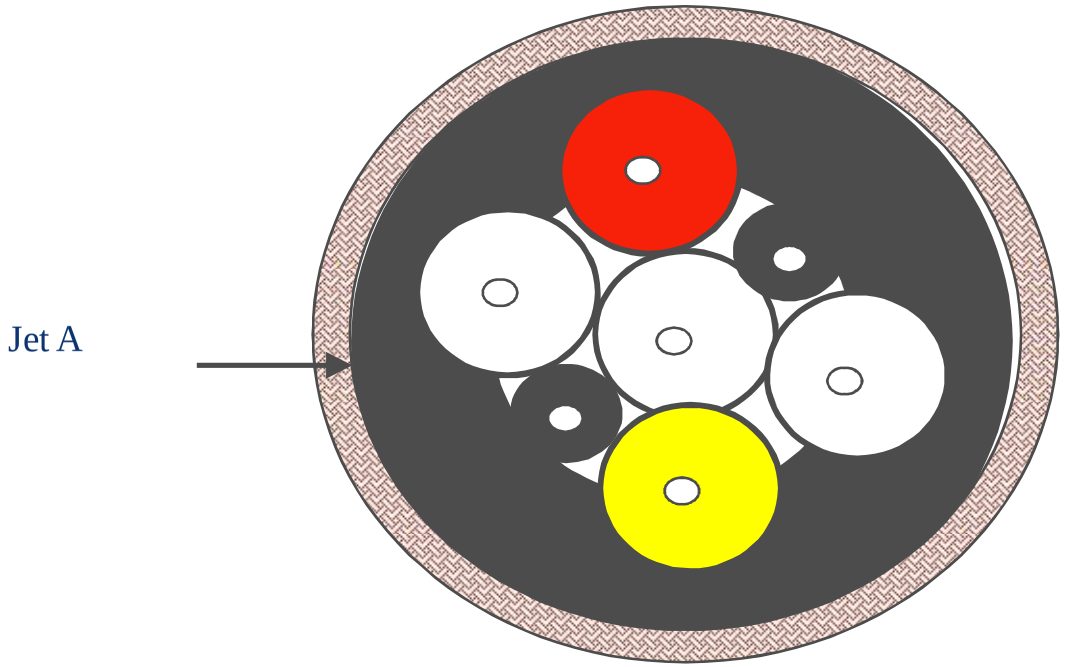
TT5000 after fuel contact



TT5000 after fuel contact

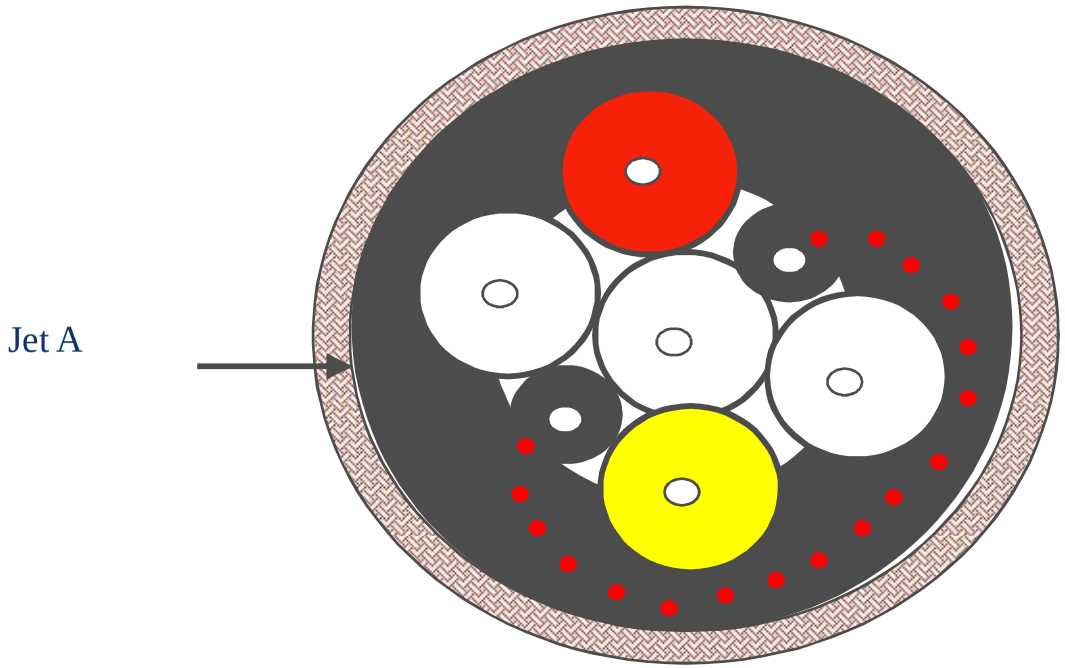


TT5000 after fuel contact



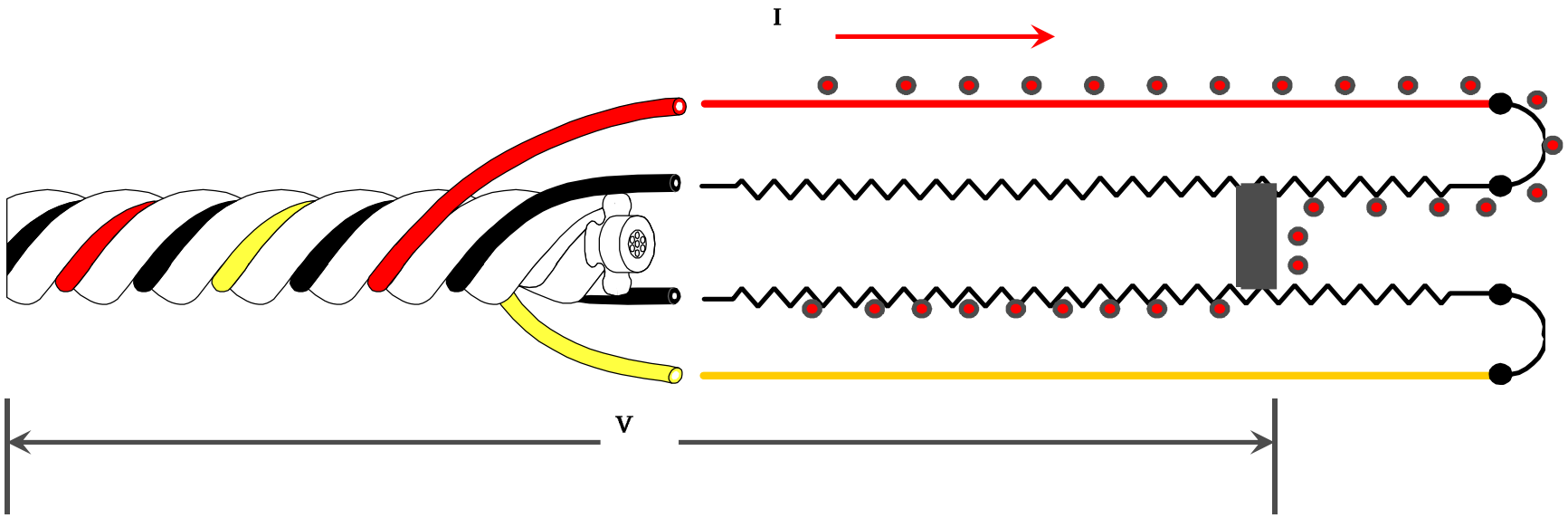
Air gap between inner wall of jacket and black electrode wires has collapsed. Detection occurs !!!

TT5000 after fuel contact



- Detection current flows through jacket.
- Leak is detected and located
- Elapsed time since initial contact <60 min (Jet-A @ 20 C)
- Fuel needed for detection < 1 ml

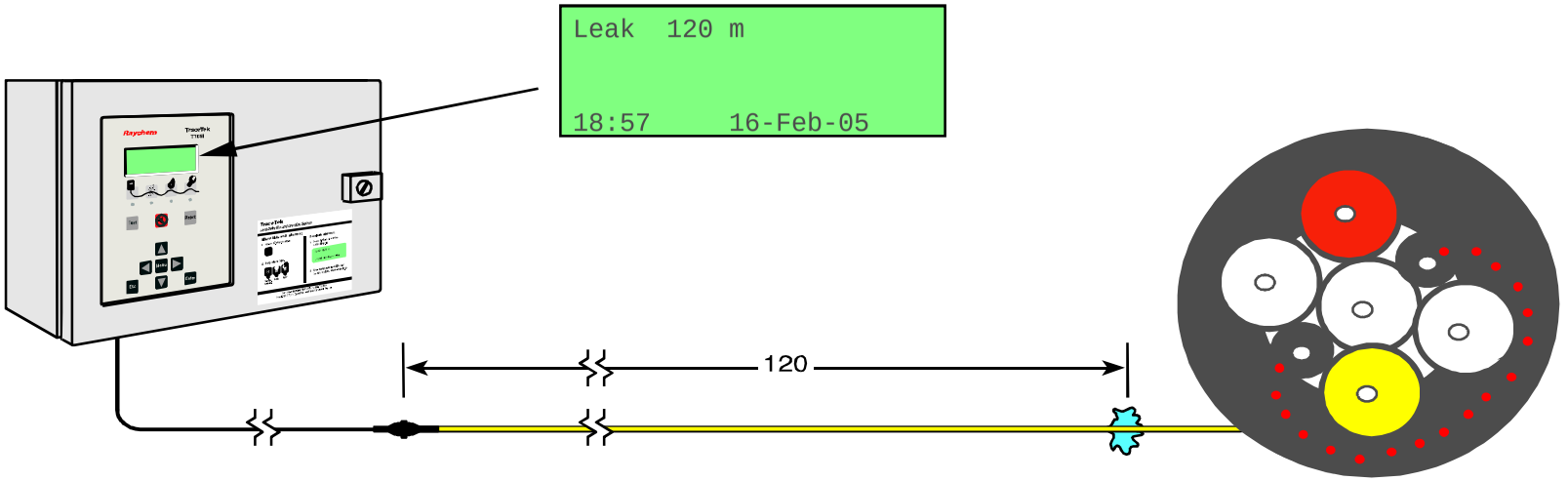
TT5000 Detection and Location

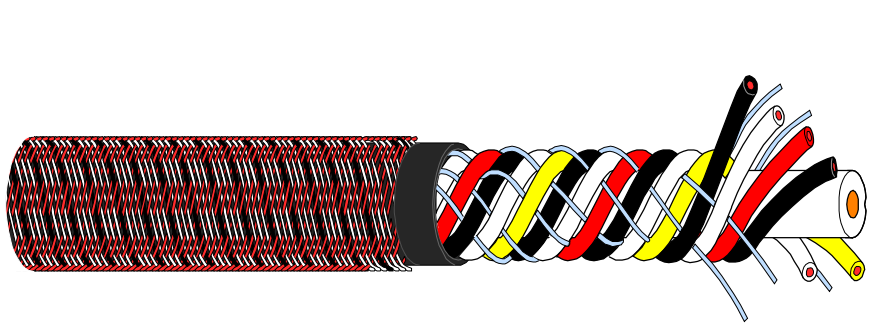


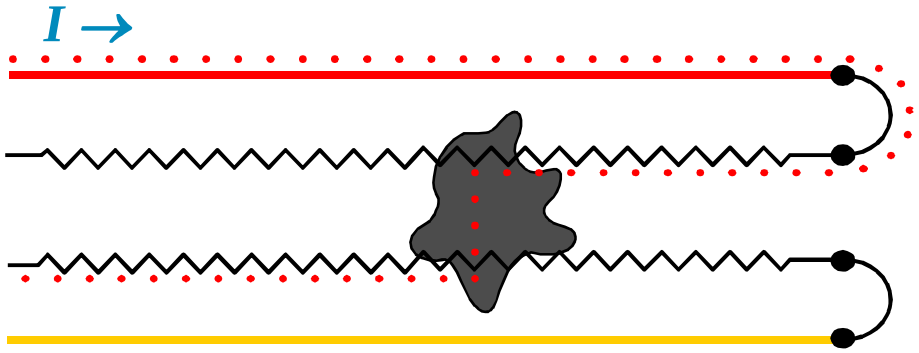
I (current) is monitored to detect a leak event

V (voltage drop along the cable) is measured to locate the leak point of contact

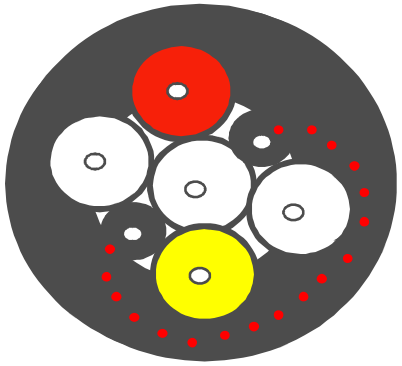
Cables Operating Principle



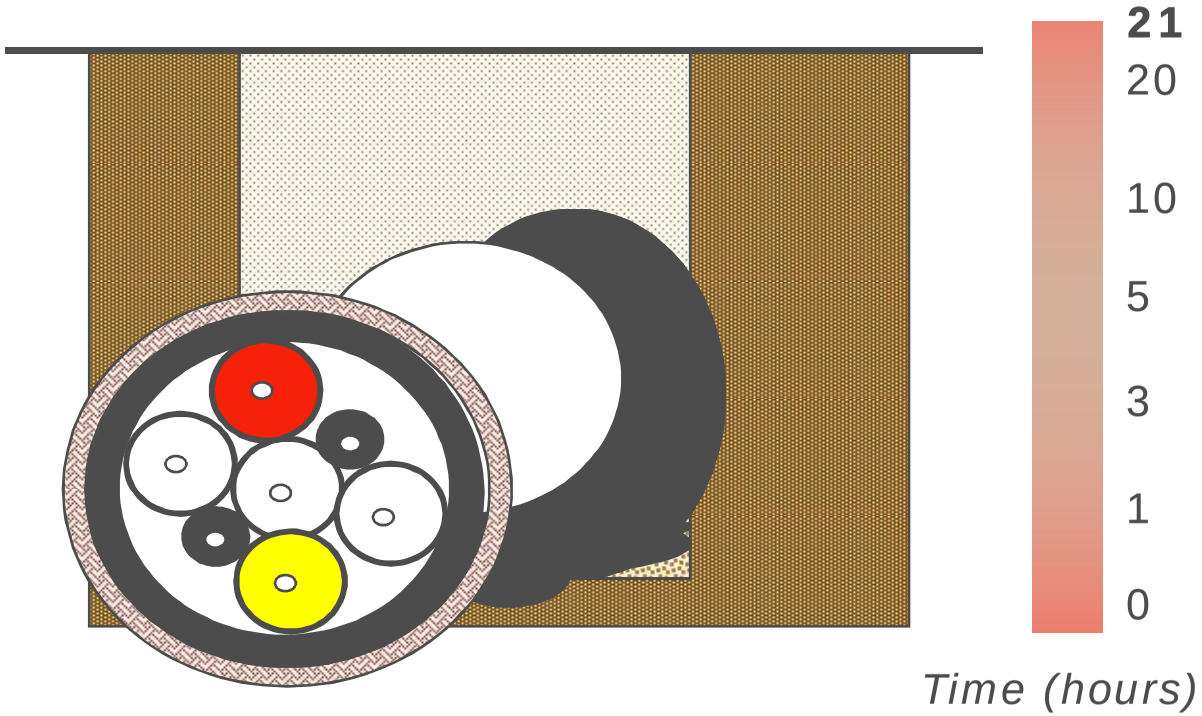




How it works

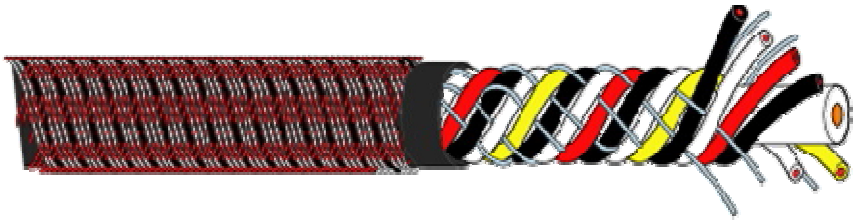


Detection at 21 hours



Animation based on 10 liter/hour leak rate
(0.001% of flow), 66% solids

External Direct Measurement



Installed below the Pipeline

High Sensitivity sensor cable


TRACETEK LIQUID LEAK DETECTION SYSTEMS

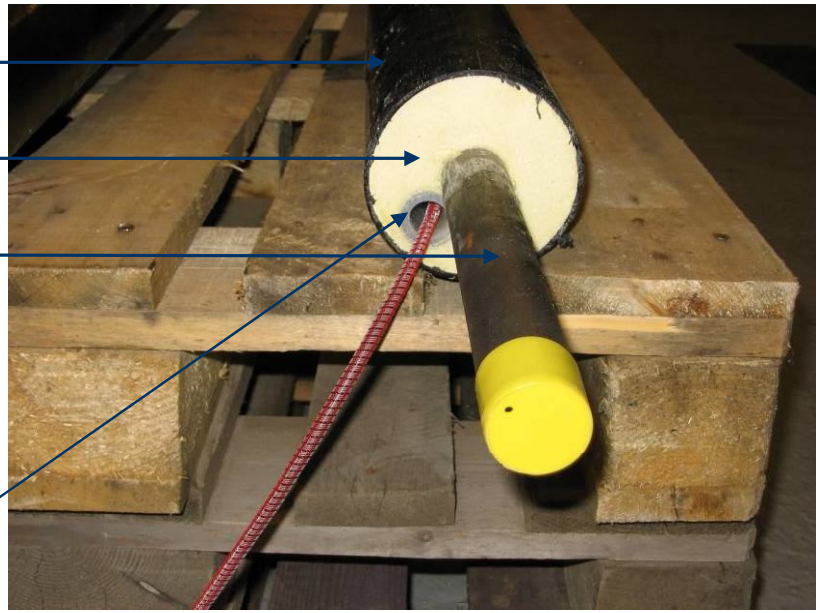
Exxon Sakhalin island / Energy E2 Denmark

Jacket pipe

Insulation

Carrier pipe

Oil detection system
Slotted plastic tube with oil sensor cable



TTDM-128 Alarm Panel

TTDM-128 Features

- **Interconnection to :**
  - SCADA system
  - Factory Automation Systems
  - Building Management Systems
  - Distributed Control Systems
  - Programmable Logic Controllers

Sensor Interface Modules

TTSIM-1

SIM-1 is the most expensive, and most accurate SIM, both in the way it delivers the excitation voltage and the methods used for measurement.

SIM-1 can monitor up to 1500 meters of sensor cable and is therefore the first choice for pipeline work

TTSIM-1A

SIM-1A is less expensive but has a more limited range: 150 m

The excitation and measurement circuit is simplified to reduce cost but a local relay has been added

SIM-1As are frequently used for water detection in buildings and for many tank farm applications.

TTSIM-2

SIM-2 uses the same circuitry as SIM-1A so the range limit is still 150 m

SIM-2 does add a three digit leak location display to help maintenance staff respond to a leak detection without having to request data from the control room

SIM-2 is also the basis of the simplified mini panels : TTA-SIM-2 and TT-BBC

TraceTek Application for Tanks Farms

The need for a new leak detection technology

- **To have notifications of leakages when the leak size is very small.**
- **To know the exact pin point location of the leakages.**
- **To enable a emergency response plan when ever there is a reported leak**
- **To save the environment from being effected by hazardous products**
- **To ensure complete safety of the Tank Farm**

Liquid Hydrocarbon Leak Detection System

***The Problem*:**

How can we minimize damage caused by small leaks that go unnoticed for long periods?

Detection of fuel leaks before the tank collapses…

Detection of fuel leaks before the tank collapses…

Pictures from the VRT internet website.

Detection of fuel leaks before the tank collapses…

Leak detection for tanks:

Quickly detect a fuel spill in time to activate the emergency response plan

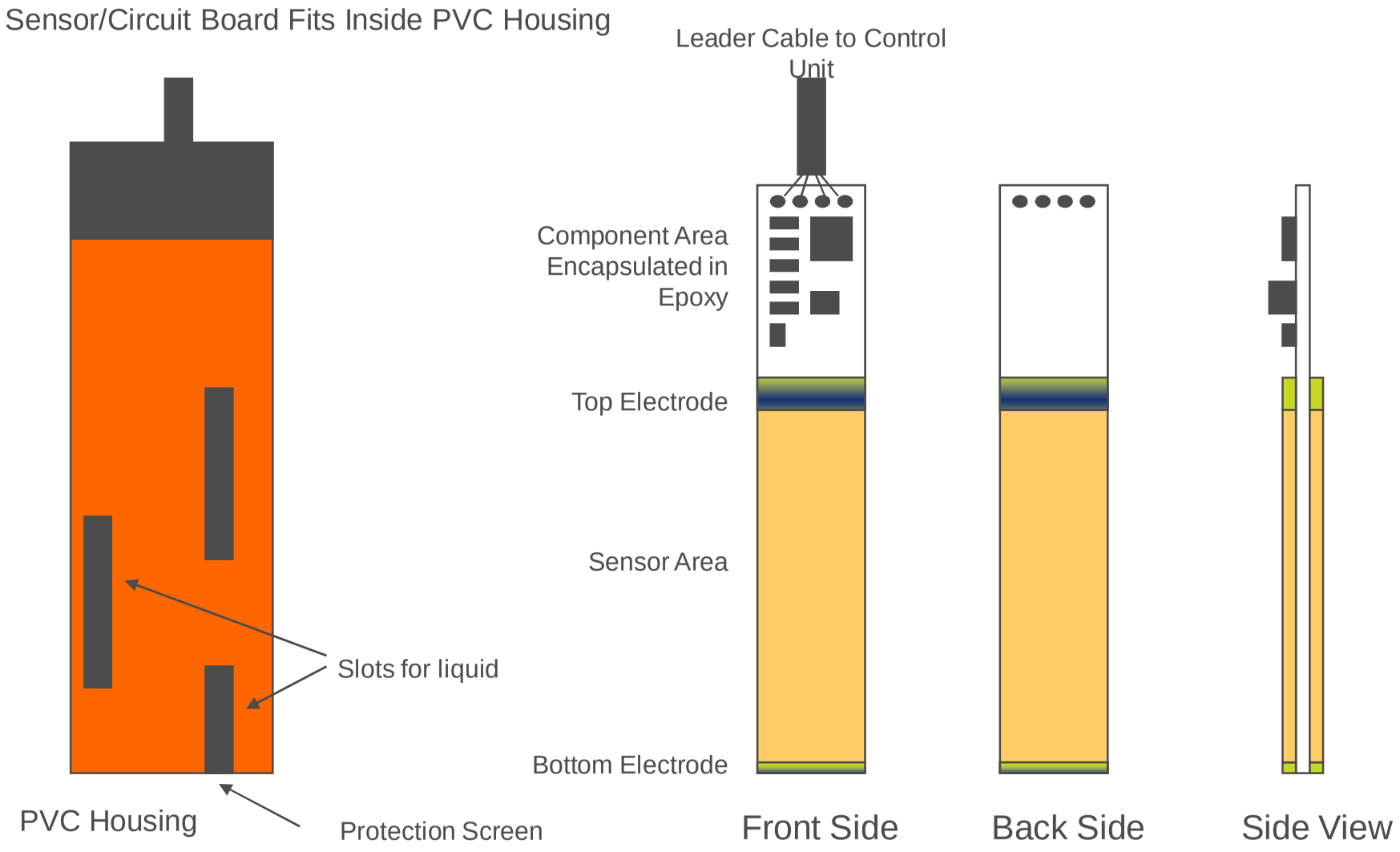
Pictures from the Buncefield Investigation Information Desk internet website. Courtesy of Royal Chiltern Air Support Unit

Quickly detect a fuel spill in time to activate the emergency response plan

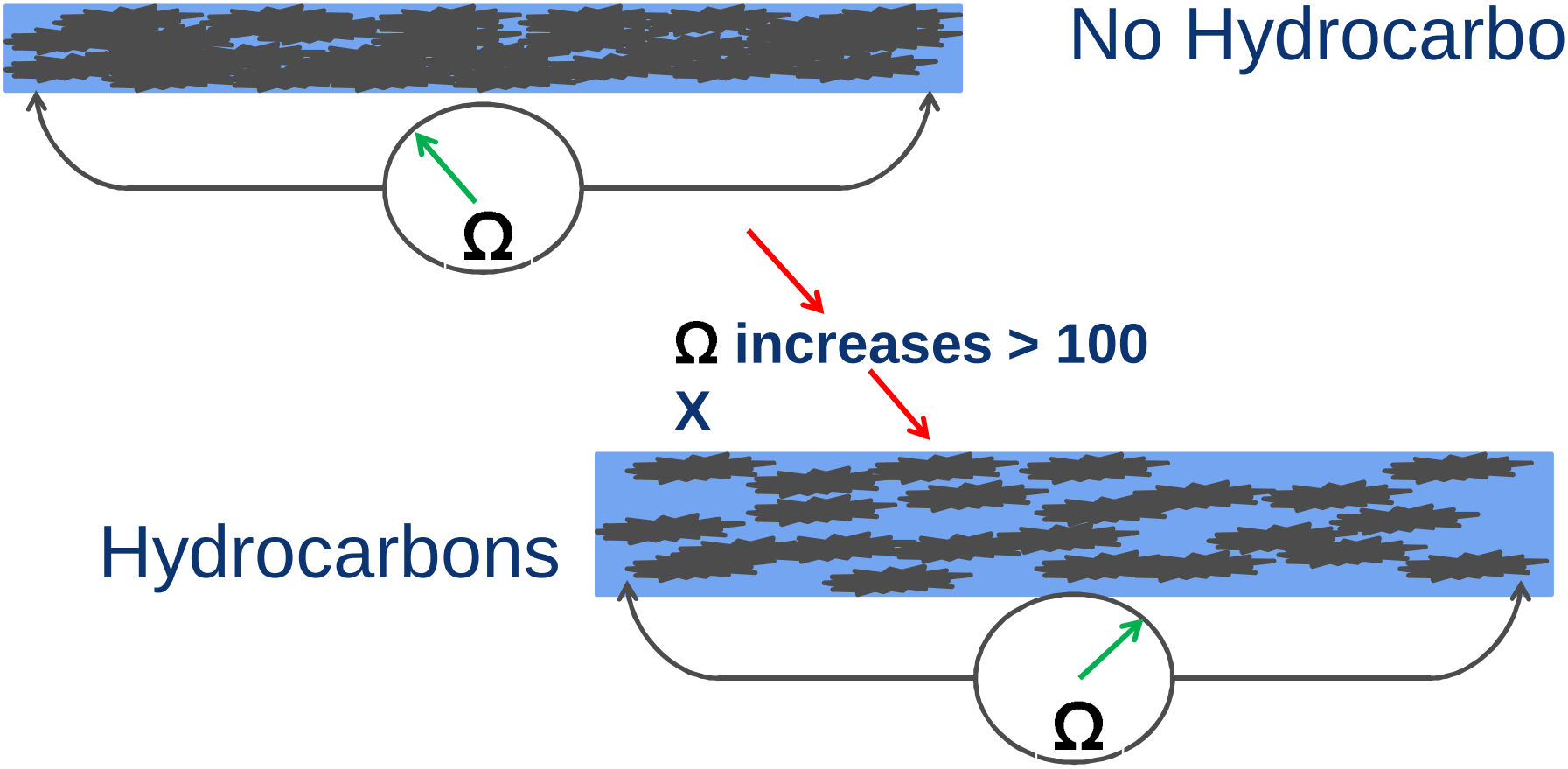
Pictures from the Buncefield Investigation Information Desk internet website. Courtesy of Royal Chiltern Air Support Unit

Fast Fuel Sensor

Fast Fuel Sensors (FFS)

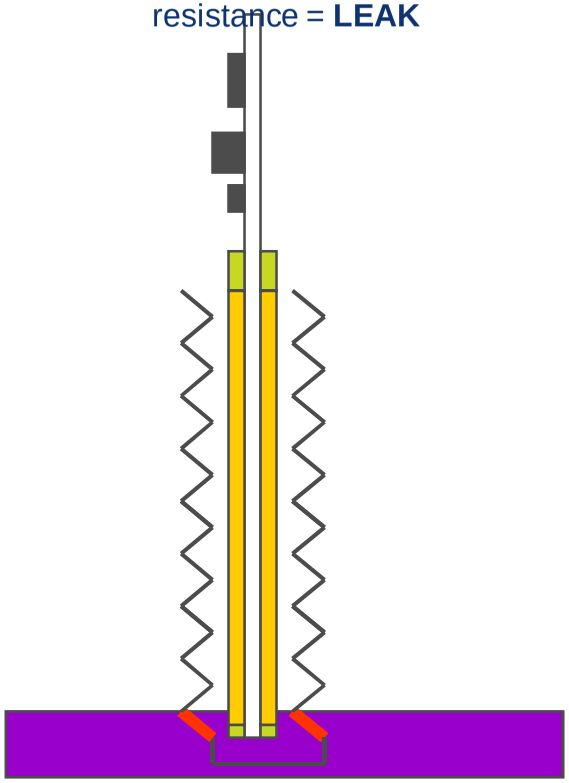


Point Detectors are based on changes in thin film resistance



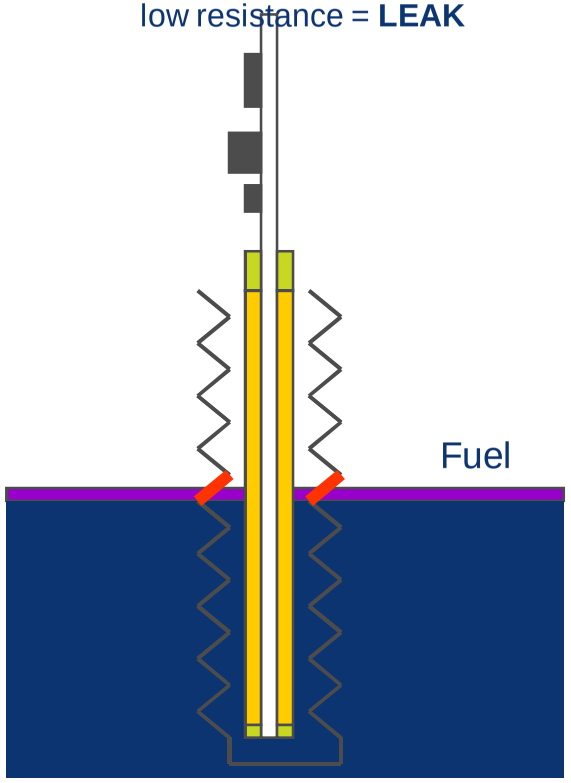
Fast Fuel Sensors (FFS)

Fuel Spill >> Output to TraceTek system is low resistance = **LEAK**



Resistance path through sensor material is high

Fuel on Water Condition >> Output to TraceTek system is low resistance = **LEAK**



Resistance path through sensor material is high

Floating hydrocarbons detection

- Early detection of fuel leaks and spills
- Quick response warning in dangerous environmental Conditions
- Detect leaks before they damage the environment
- Cost effective solution for safety and environmental protection

DESIGN FEATURES

- • Fast response to small amount of fuel
- • Resets for multiple uses
- • Easily tested
- • Compatible with TraceTek Instruments
- • Intermix up to 6 FFS probes with TT5000 sensor cable to form hybrid cable and
- probe systems
- • Suitable for installation in C1D1 (Zone 0) with appropriate safety barrier

• SIL-2 Rated Safety System Component

Multiple Applications

The TT-FFS sensor can be used for multiple applications:

- Refineries and tank farms safety monitoring
- Tank's roof rain water monitoring
- Tank farm bunded areas monitoring
- Industrial plant waste water monitoring
- Downstream checking of the oil separators in water treatment processes
- Safety and environment monitoring in Petrol Filling Stations

Tank Overfill Detection

Tank Overfill Detection

Water Drains

Near Valves

Sump Pit

TT-TAR Transducer

2-wire 4-20 mA Output

Current (mA)	System Status
Output <3.5	Damaged wire between control room and transmitter
3.5 < Output < 5	Cable Break in sensor circuit
5 < Output <11	System Normal – No LEAK No BREAK
Output > 11	One or more FFS has detected a leak

TT- FFS Fast Fuel Sensor – APPROVALS

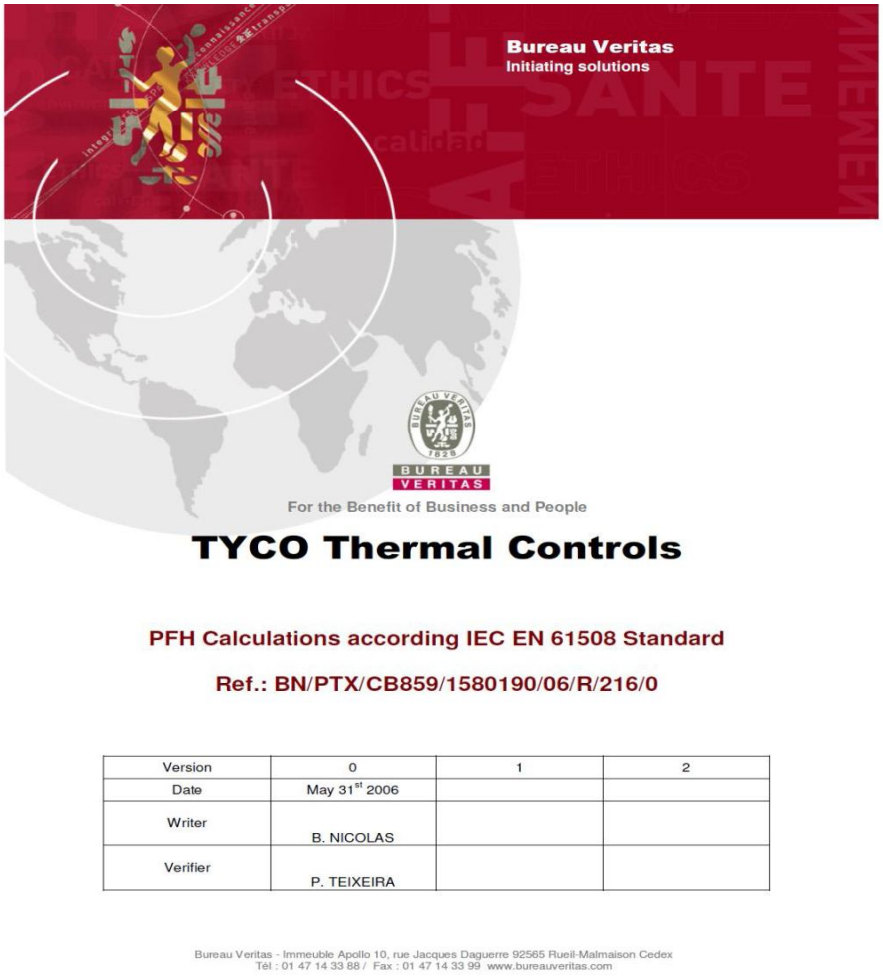
IS/Class I, Div. 1, Groups A, B, C, D/T4; Class I Zone 0, AEx ia IIC T4 Certifcate: J.I. 302535
NI/Class I, Div. 2. Groups A, B, C, D/T4; Class I Zone 2, Group IIC T4

IEC 61508 Safety Integrity Level -2 (when used with TTC-1)
Ref BN/PTX/CB859/158019O/06/R/216/0

II 1/(1) SYST G EEx ia/[ia] IIC T6 LCIE 06 ATEX 6086 X

II 2/(1)/1 SYST G EEx d [ia] ia IIB/IIC T6 LCIE 06 ATEX 6086 X

TT- FFS Fast Fuel Sensor – SIL 2 APPROVAL



5. Conclusion & Limits of the report

5.1 Conclusion

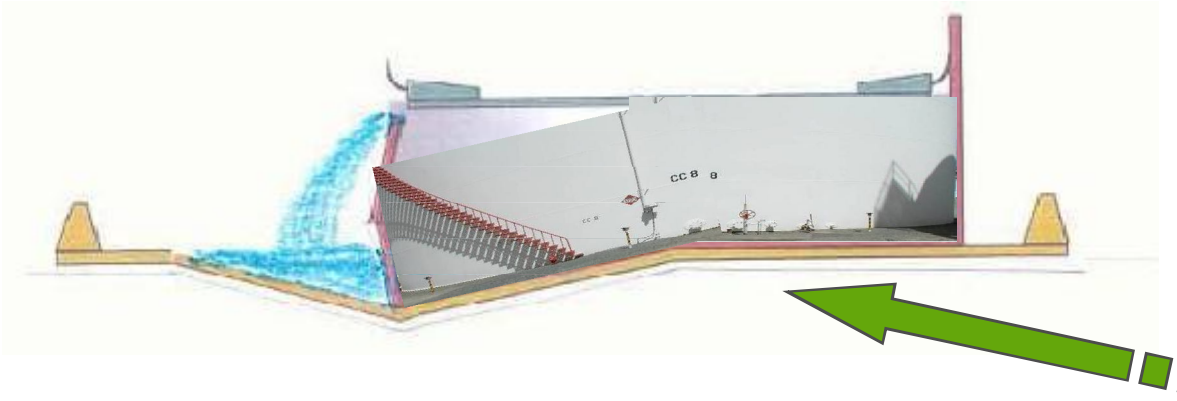
According to the field calculations based on the documents given by TYCO, the following configurations of "Pneumatic Leak Detector" systems have PFH & SFF suitable to use in safety loops SIL 2:

- Configuration N°1:
  1 component TTC-1 (Detection Module)
  1 component FFS (Sensor)
  1 cable

- Configuration N°2:
  1 component TTC-1 (Detection Module)
  6 components FFS (Sensor)
  1 cable

Leak Detection From Tank Bottom Plate

Fractured tank



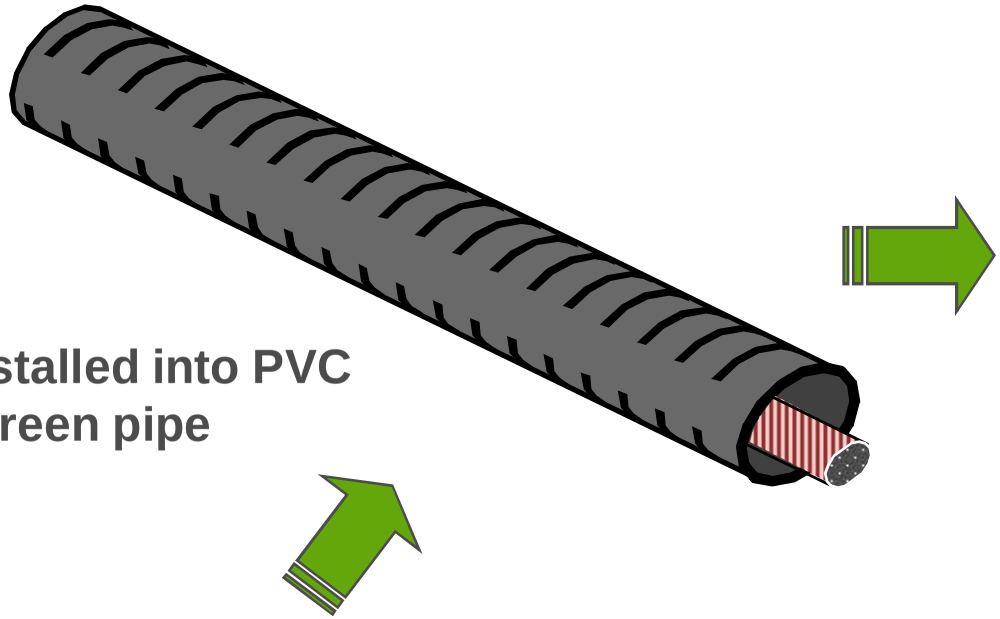
fractured bottom plate, => large spill

⇒Ground subsidence => bund explosion / fire => tank fire

<u>Prevention measure:</u>

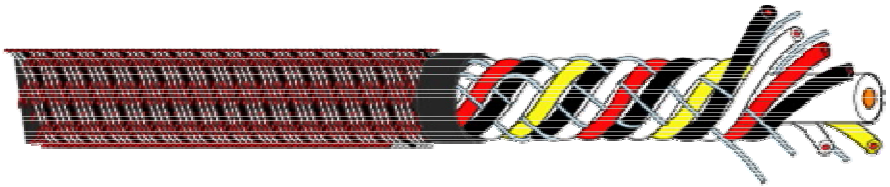
liquid detection systems under the bottom plate or in the service void : sensing cables buried within slotted pipes

External Direct Measurement



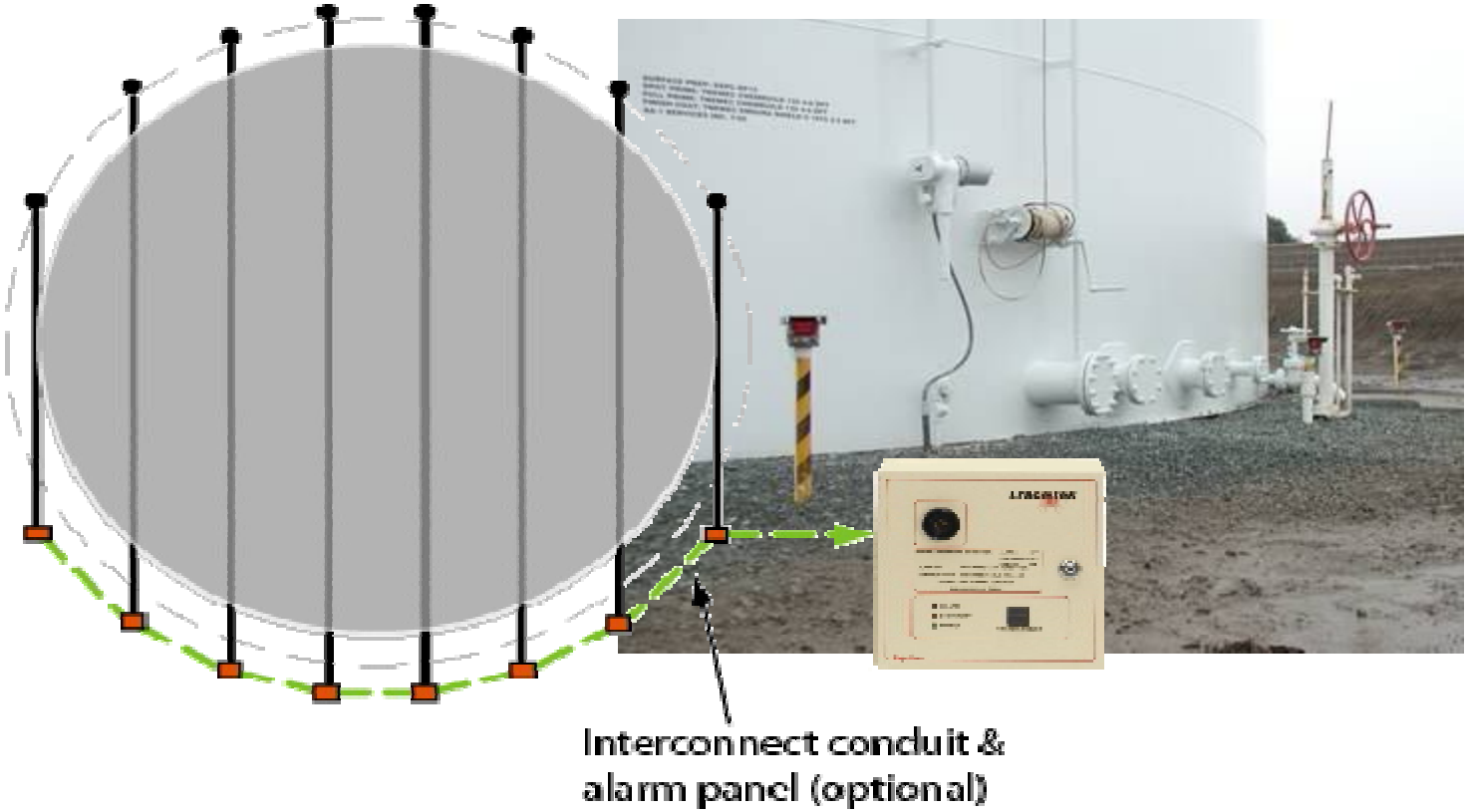
Installed into PVC screen pipe

High Sensitivity sensor cable



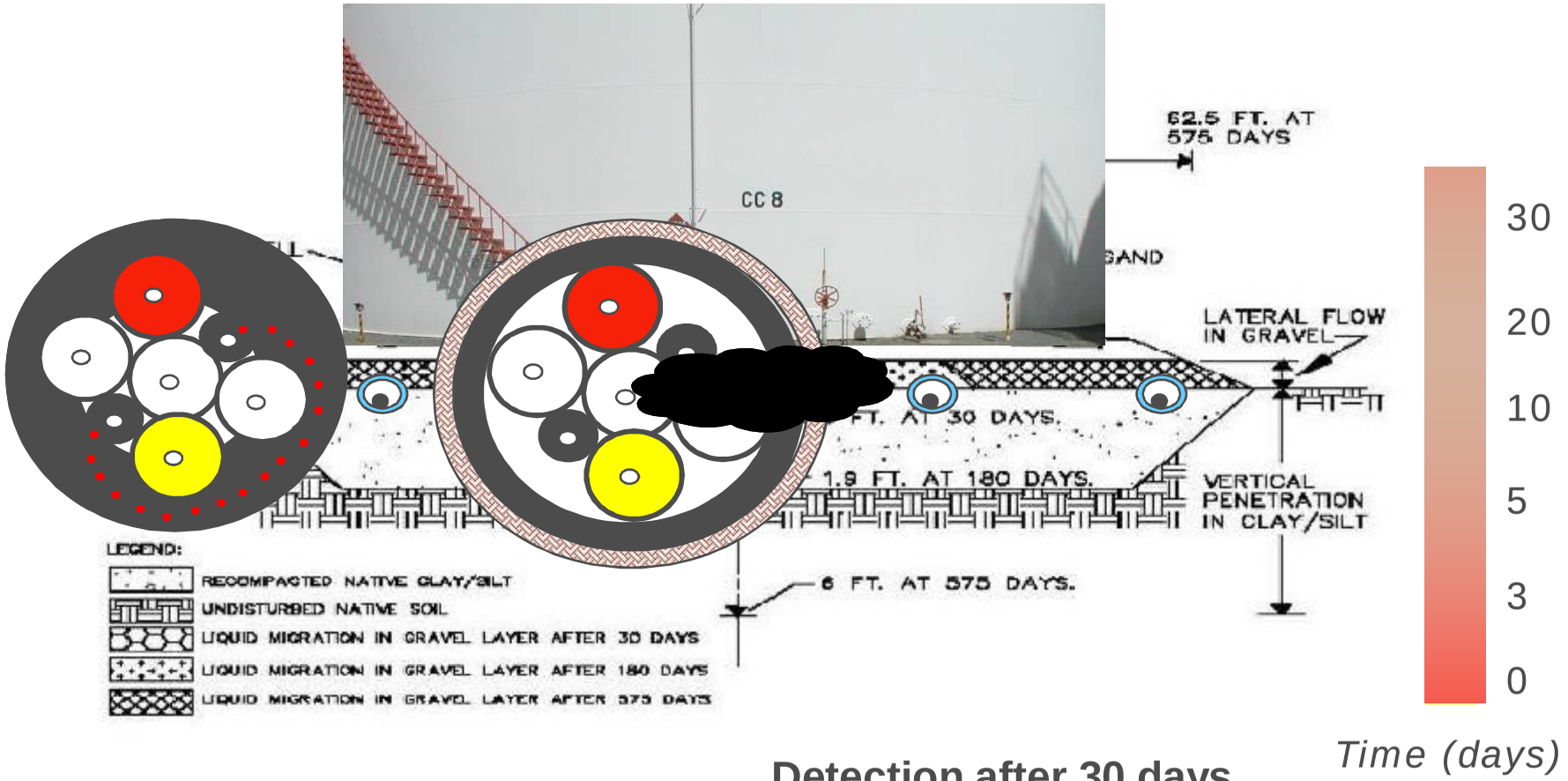
Positioned under tank bottom, beneath valves or along side a pipeline

Tank monitoring



Typical plan view

Underground leak scenario

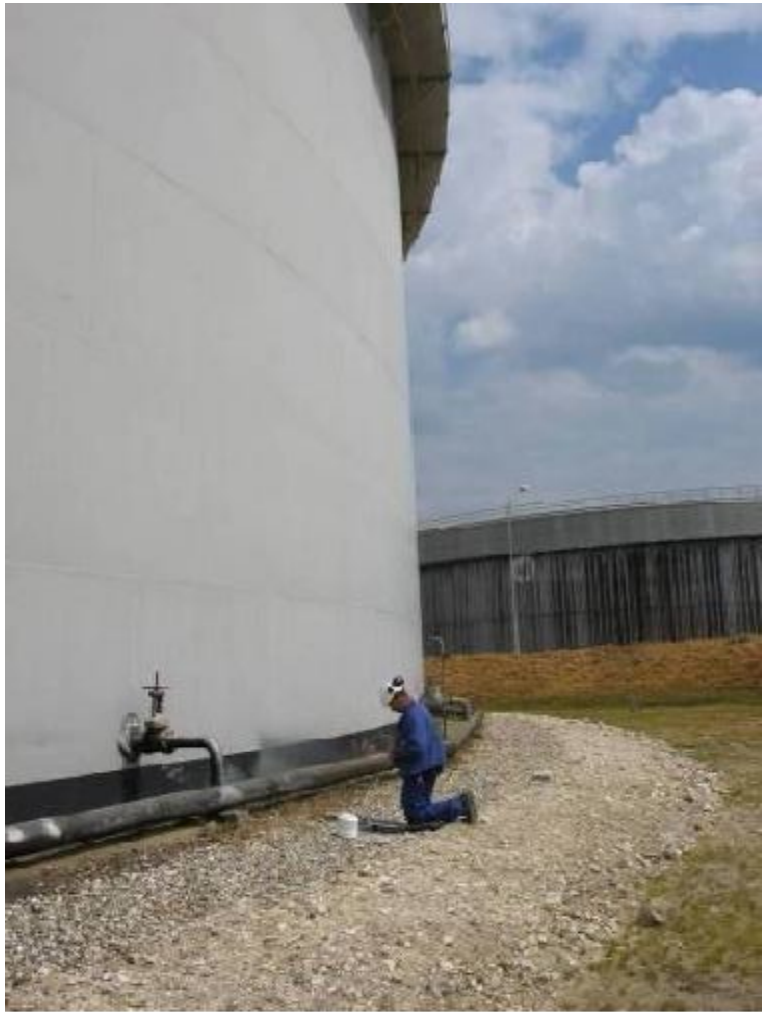


Detection after 30 days

Animation based on 3.8 liter/hour leak rate

AST Tank Floor monitoring

Hidden leaks under control



Hidden leaks under control

Approvals & Listings

TraceTek Approvals and Certifications

ISO 9001

Products have American, Canadian and European agency approvals

Florida State EPA Approval

NWGLDE Listing

American Petroleum institute: API 1160

Managing System Integrity for Hazardous Liquid Pipelines

API STANDARD 1160
FIRST EDITION, NOVEMBER 2001

American Petroleum Institute

Helping You Get The Job Done Right.℠

ngth ical tracer is not a component of the pipeline contents and
ipe- does not occur naturally in the soil. After inoculation of the
CAs, pipeline with the tracer chemical, samples of the vapor con-
risk tained in the soil outside the pipeline are collected. The soil
such vapor samples are obtained from probes or other devices
rms installed intermittently along the pipeline. The vapor samples
ten- are analyzed by a gas chromatograph for the specific tracer
any chemical that was mixed with the pipeline contents. Presence
of the tracer chemical in the sample can only occur through
fac- an active release of pipeline product mixed with the tracer
with into the soil. These systems are able to provide single or con-
nce tinuous liquid tightness tests and will provide release location
ion. information.
rms *Release detection cable.* Release detection sensing cables
ten are designed to alarm after contact with liquid hydrocarbons
ipe- at any point along their length. The presence of hydrocarbons
the creates a circuit between two sensing wires and triggers an
alarm. Typically, leak detection cable is installed in slotted
ons PVC conduit that is buried in the pipe trench along or below
and the pipeline. These systems provide continuous monitoring
era- via electronic control units capable of interfacing with
ical SCADA technology and are able to provide leak location
port information.
sys- *Shut-in (static) release detection.* This technique basically

References

References

Longhorn Pipeline – USA

This project consists of 8 miles of 18” buried single wall transmission pipeline carrying jet fuel, gasoline and diesel from Houston TX to El Paso TX. The entire project is 495 miles in length, the 8 miles nearest to Austin Texas will deploying TraceTek 5000 sensor cable. This system will uses a TTDM-PLUS and approximately 10 TTSIM-1’s. The TTDM-PLUS Modbus data will be connected to the SCADA system for monitoring in a control room in Tulsa OK

References

Kinder Morgan – USA

Above Ground Storage Tanks – Approximately 125 large above ground storage tanks are fitted with TT5000 in slotted conduit. These above ground storage tanks and buried cutout valves are part of the California pipeline network supplying jet fuel to major airports in San Francisco and Los Angeles as well as gasoline and diesel fuel for other transportation needs.

Detailed Document

References

Forthood – USA

Military /civilian air field in Texas. Hydrant fuel system using approximately 1600 M of TT5000, 3 TTSIM-1's and a TTDM-PLUS. System monitors a hydrant fueling pipe network with approximately 8 hydrant fuel pits. This is the airport facility for the "Air Force One", the Boeing 747 used when President takes holidays at his Texas ranch.

References in USA

- TRANSMONTAIGNE – TAMPA – 3 tanks
- TRANSMONTAIGNE – Port Everglades 4 tanks
- TRANSMONTAIGNE – Pensacola – 4 tanks
- MOTIVA -- Tampa – 1 tank
- MOTIVA -- Port Everglades 1 tank
- HESS -- Port Everglades 1 tank
- City of Tallahassee -- Tallahassee – 1 tank
- City of Tallahassee -- St. Marks – 2 tanks
- NU-STAR -- Jacksonville – 4 tanks

Other References

France and Belgium:

- **TOTAL and TOTAL Chemical – several refinery and tank farm sites throughout France and Belgium**

UK:

- **BP Oil UK Limited – Buncefield, Hamble, Dalston and Northhampton,**
- **CONOCO-PHILLIPS – Humberside refinery and Tank Farm**
- **ROYAL PORTBURY DOCKS – Bristol**

China:

- **Guangzhou Expressway Fuel Operations - 6 gas station tank vaults along new expressway**

Shaklin Island, Russia

- **Exxon Mobile**

Airport projects

- **Military Airport Fort Hood Texas**
- **JFK Airport New York**
- **San Diego / Los Angeles Airport CA**
- **Madrid Barajas Airport Spain**
- **Caslav Nato Airport Czech Republic**
- **Narita Airport Japan**
- **Indian Air force base Agra**
- **Barcelona airport**