NPS/002/036 – Technical Specification for Perfluorocarbon Tracer (PFT)

1. Purpose

This specification details the technical requirements for perfluorocarbon tracers (PFTs) that can be used for location applications. In terms of Northern Powergrid, PFT shall be injected in a controlled manner into EHV and 132kV oil and gas power cables to combine with the insulation medium to trace and locate oil and gas leaks that enter the environment.

This document supersedes the following documents, all copies of which should be destroyed;

Document Reference	Document Title	Version	Published Date
n/a			

2. Scope

This specification covers the specific perfluorocarbon tracers used in the process of detecting leaks from oil and gas power cables.

It does not cover the specific process for the injection, application and detection techniques used to apply the PFT in Northern Powergrid.

The following appendices form part of this technical specification.

- Appendix 1 – Requirements and Commodity Codes
- Appendix 2 - Addendum to Supplier Requirements
- Appendix 3 – Logistical Requirements
- Appendix 4 – Self Certification Conformance Declaration
- Appendix 5 - Technical Information Check List

2.1. Table of Contents

3. Technical Requirements

3.1. Compliance with Other Specifications and Standards

Technical documents referenced within this specification refer to the latest versions of the relevant International Standards, British Standard Specifications and all relevant Energy Networks Association Technical Specifications (ENA TS) current at the time of supply.

3.2. Product Composition

The product composition shall be a Low viscosity compound based on a blend of linear alkyl benzenes that have side alkyl chains of 10 – 13 carbon atoms in length.

The synonym shall be described as a 'Linear Alkyl BenzenesAlkyl C10-C13, benzenes Benzene, C10-13-alkyl-deriv.' Detergent Alkylate.

Composition	EINECS number	CAS number	Symbol letters	Risk numbers	Concentration
C10 – C13 Linear Alkyl Benzenes	267-051-0	67774-74-7	Not regulated	Not Regulated	98%

All constituents of this product shall be listed in EINECS (European Inventory of Existing Commercial Chemical Substances) or ELINCS (European List of Notified Chemical Substances) or are exempt.

The detailed product composition (including each unique 'signature' discussed in section 3.5) injected into the power cables for fluid leak location shall be made available to Northern Powergrid upon request.

3.3. Material Properties

The product shall be of a liquid form and provide the following properties when in use:

- Colourless/Clear,
- Non-flammable,
- Non-toxic,
- Chemically inert,
- Non-radioactive.

3.4. Compatibility/Interaction with Power Cable Insulation Materials

The primary requirement is for PFT to act as a tracer material that when injected into the power cable it can easily flow without any restriction to the point at which the oil/gas insulant leaves the cable and into the environment.

The PFT cannot carry out its function without using the oil/gas power cable insulant as a method of transport along the cable. Although in contact, the PFT must not be absorbed into the gas/oil or result in a change of state.

The main types of oils/gases used in our power cable population are as follows:

- Gas – Nitrogen (Oxygen Free),
- Oil – T 3788 (Benzene, C10-13-alkyl derivatives),
- Oil – C14B (Wholly linear synthesised alkylbenzene (mainly dodecylbenzene)),
- Oil – C14 (Synthetic oil filled cable impregnant consisting mainly of dodecylbenzene)
- Oil – C6 (Highly refined mineral oil)

3.5. Levels of Detection/Identification

To ensure accuracy of location at the point of which the PFT leaves the power cable it is important that concentration levels are kept as low as operationally practicable. For the purposes of this specification the PFT must be readily detected at concentration levels of 1 part in 1015 litres volume (One thousand trillionth).

The general methodology for leak detection shall be based upon detection of the inserted PFT fluid containing electrons and measuring the levels of negative ions produced. This is the preferred approach as it enables on site analysis which results in reduced leak detection time. To ensure that multiple traces can take place in the same geographical area the PFT must be able be 'tagged' by a 'unique signature' to support individual leak identification and location. Ideally a minimum of 10 'unique signatures' are required for differentiation of individual cable circuits leaving/entering the substation.

3.6. Methods and Criteria for Detection/Identification

As power cables run through various types of land from arable, to parkland, footpaths, and carriageways, the PFT must be detectable via a device/process that can be facilitated from a vehicle or on foot where vehicular access is not possible.

If required, collected samples shall be able to be analysed in the field without the need to be returned to a laboratory to minimise leak detection times.

In addition, the PFT shall be detectable whilst taking account of the following criteria:

Can detect leaks on cables, joints, tanks, pipework and ancillaries,

Can be detected at any depth below ground,

Multiple leaks can be detected on the same power cable,

Does not require any significant excavation to allow detection.

4. References

The products described within this specification shall comply with all current versions of the relevant International Standards, British Standard Specifications and all relevant Energy Networks Association Technical Specifications (ENATS) current at the time of supply.

4.1. External Documentation

Reference	Title
	European Inventory of Existing Commercial Chemical Substances
	European List of Notified Chemical Substances

4.2. Internal Documentation

Reference	Title
n/a	

4.3. Amendments from Previous Version

Reference	Description
n/a	

5. Definitions

Term	Definition
PFT	Perfluorocarbon Tracer
CAS	Chemical Abstracts Service

6. Authority for Issue

6.1. CDS Assurance

I sign to confirm that I have completed and checked this document and I am satisfied with its content and submit it for approval and authorisation.

		Date
Liz Beat	Governance Administrator	13/10/2022

6.2. Author

I sign to confirm that I have completed and checked this document and I am satisfied with its content and submit it for approval and authorisation.

Review Period - This document should be reviewed within the following time period;

Standard CDS review of 3 years?	Non Standard Review Period & Reason	
No	Period: 5 Years	Reason: Update will be dictated by contract renewal date or any significant changes in the specification or documents referenced
Should this document be displayed on the Northern Powergrid external website?		Yes

		Date
Paul Hollowood	Asset Management Engineer	17/10/2022

6.3. Technical Assurance

I sign to confirm that I am satisfied with all aspects of the content and preparation of this document and submit it for approval and authorisation.

		Date
David van Kesteren	Policy & Standards Manager	20/10/2022
Anna Stevenson-Trippett	Programme Manager	14/10/2022
David Rhodes	Programme Manager	19/10/2022
Joe Helm	Policy & Standards Manager	26/10/2022

6.4. Authorisation

Authorisation is granted for publication of this document.

		Date
Paul Black	System Engineering Manager	28/10/2022

Appendix 1 – Requirements and Commodity Codes

Description	Northern Powergrid Commodity Code
Perflourocarbon Tracer (PFT) used for Cable Fluid Leak Location	XXXXXX

Appendix 2 – Addendum to Supplier Requirements

The supplier shall provide with the tender full technical details of the equipment offered and shall indicate any variation from these standards or specifications.

Specialist tooling shall be required for the application/installation of perfluorocarbon tracer into power cables.

Hazard Identification

Classification of preparation:

This product is not classified as a dangerous substance / preparation in accordance with The Chemicals (Hazard Information

and Packaging for Supply) Regulations 2002 (CHIP3).

Physical and Chemical Properties:

Not classified as flammable but will burn. Avoid contact with strong oxidisers.

Health Effects Skin:

Repeated or prolonged contact with the skin may result in irritation or drying of the skin, progressing to dermatitis.

Eyes:

Contact with the eyes may result in irritation

Ingestion:

Ingestion of small amounts may cause nausea and vomiting.

Inhalation:

Due to low volatility, this product should not present an inhalation hazard under ambient conditions. Exposure to oil mists may irritate the mucous membranes and cause dizziness, headaches and nausea.

Environmental Effects:

No specific hazards under normal use conditions

Appendix 3 – Logistical Requirements

To enable the Company to store the product(s) in accordance with the manufacturer's recommendations the Tenderer should provide details of the recommended storage environment with respect to each tendered product.

Details should be provided where relevant in respect to the minimum and maximum exposure levels, frequency of exposure and duration of exposure of the packaged item with respect to;

- Ambient temperature
- Humidity
- Water
- Dust
- Atmospheric corrosion
- Impact
- Vibration
- Solar radiation

The Tenderer shall ensure that each item is suitably packaged and protection to maintain the product and packaging as "fit for service" prior to installation taking account of the potential for an outdoor storage environment. All packaging shall be sufficiently durable giving regard to the function, reasonable use and contents of the packaging. Where product packages tendered are made up of sub packages all the sub packages shall unless varied by this specification, be supplied securely packaged together. Where items are provided in bagged/boxed form the material from which the bags are manufactured shall be capable of sustaining the package weight and resisting puncture by the materials within. Tenderer shall submit at the time of tendering the details of the proposed packaging (i.e. materials composition and structure) to be used for each product. Where the Tenderer is unable to provide packaging suitable for outdoor storage then this should be stated at the time of tender.

Palletised goods shall be supplied on standard 1200mm x 1000mm pallets.

Clearly legible, easily identifiable, durable and unambiguous labelling shall be applied to each individual and where relevant multiple packages of like products. Where product packages tendered are made up of sub packages each sub packages shall be marked. As a minimum requirement the following shall be included;

- Manufacturer's trademark or name
- Supplier's trademark or name
- Description of item
- Date of packaging and/or batch number
- Northern Powergrid product code
- Weight

Tenderer shall submit at the time of tendering a sample of the proposed labelling for each product package type.

Appendix 4 – SELF CERTIFICATION CONFORMANCE DECLARATION

The Technical Specification for perfluorocarbon tracer shall comply with the latest issues of the relevant national and international standards.
Additionally this technical specification is intended to amplify and/or clarify requirements relating to these Standards.

This self-declaration sheet identifies the clauses of the aforementioned standards relevant to perfluorocarbon tracer for use on the Company's distribution network. The manufacturer shall declare conformance or otherwise, clause by clause, using the following levels of conformance declaration codes.

Conformance declaration codes
N/A = Clause is not applicable/ appropriate to the product
Cs1 = The product conforms fully with the requirements of this clause
Cs2 = The product conforms partially with the requirements of this clause
Cs3 = The product does not conform to the requirements of this clause
Cs4 = The product does not currently conform to the requirements of this clause, but the manufacturer proposes to modify and test the product in order to conform.

Instructions for completion

- When Cs1 code is entered the supplier shall provide evidence of conformance
- When any other code is entered the reason and supporting evidence for non-Conformance shall be entered
- Prefix each remark with the relevant 'BS EN' or 'ENATS' as appropriate
- Provide technical data sheets and associated drawings for each product.

Manufacturer / Supplier:

Manufacturer / Supplier Product Reference:

Northern Powergrid Product Reference (Commodity Code):

Details of the Product Type (Voltage, Type and Size)

Name:

Signature:

Date:

NOTE: One sheet shall be completed for each item or variant submitted.

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Clause/Sub-clause	**Requirement**	**Conformance Code**	**Evidence Reference**	**Remarks / Comments**
Composition	Low viscosity compound based on a blend of linear alkyl benzenes that have side alkyl chains of 10 – 13 carbon atoms in length.			
pH:	Not determined			
Boiling point/range:	280 - 320°C			
Flash point: Flammability:	>135°C			
Explosive properties:	Non-flammable. Not explosive			
Oxidising properties:	Not applicable			
Vapour pressure at 20°C:	<0.1 mbar			
Density:	0.86 g/cm^{-3} at 20°C typical			
Solubility in water at 20°C:	40 *U*g/l			
Kinematic Viscosity at 20°C:	4.0 – 4.5 cSt (4.0 – 4.5 mm^2/s)			
Vapour density (Air=1):	8.4			
Evaporation rate:	Not determined			

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Clause/Sub-clause	**Requirement**	**Conformance Code**	**Evidence Reference**	**Remarks / Comments**
Stability & Reactivity	Stable under normal ambient and anticipated storage and handling conditions of temperature and pressure			

Appendix 5 - Technical Information Check List

The Following information shall be provided by the supplier for technical review by the company.

Additional information shall be provided if required.

Requirements	Provided (Yes / No)
Drawings and product data sheets for each item offered	
Full product descriptions part/reference numbers	
Appendix 4 – Completed self-certification conformance declaration	
Type test evidence	
Packaging/delivery information	
Product quality plan	