national gas transmission

Notes on Completion: Please refer to the appropriate NIA Governance Document to assist in the completion of this form. The full completed submission should not exceed 6 pages in total.

NIA Project Registration and PEA Document

Date of Submission

Jan 2014

Project Reference Number

NIA_NGGT0026

Project Registration

Project Title

Study to determine Stress Concentration Factors (SCF) for alternative design on branch connections

Project Reference Number

NIA_NGGT0026

Project Licensee(s)

National Gas Transmission PLC

Project Start

February 2013

Project Duration

1 year and 6 months

Nominated Project Contact(s)

Robert Bood (box.GT.innovation@nationalgrid.com)

Project Budget

£61,000.00

Summary

A number of major manufacturers are now producing variations of the insert weldolet for use as branch connections to transmission pipe work replacing the conventional sweepolet design. The insert weldolet would offer the following benefits over the traditional version:

- Shorter Installation time, and hence reduced costs
- Simpler design and reduced manufacturing costs
- Reduce reliance on a small number of suppliers, improving lead time.

Before National Grid can adopt the use of the insert weldolet , there needs to be clear evidence as to the mechanical viability of these designs. This analysis is to be addressed by this programme.

Third Party Collaborators

DNV

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

One of the principal methods for making branch connections to transmission pipe work is to use a fitting generally known as Welded-in

Contour Insert (WICI). These come in two distinct forms:

1. The traditional version, usually referred to by its trade name Sweepolet, which has a smooth swept transition from the edge weld into the carrier pipe through to the branch.
2. A newer design, sometimes referred to as an Insert Branch Outlet or an Insert Weldolet, is of a more compact and stockier shape but still exhibits a smooth transition but less swept.

A number of the major weldolet manufacturers are now producing variations of the insert weldolet design and their adoption could potentially offer a wide range of benefits to National Grid.

Method(s)

The original method was to use 3D finite element analyses (FEA) to determine the stress concentration factors (SCFs) of two sizes of insert weldolet that have the most extreme ratios in header to branch diameter. These two finite element analyses have been successfully completed and stress concentration factors determined. The results have been reviewed and the conclusion is that additional analyses are necessary to be able to define a range of geometries over which the SCFs can be used for the insert weldolet. It has been established that the eight additional models will be required to be assessed in order to successfully determine if the SCFs of the insert weldolets are bounded by criteria used in the pipe work stress analysis code IGEM/TD/12. These models will be performed via FEA as per the original method.

Scope

A number of major manufacturers are now producing variations of the insert weldolet for use as branch connections to transmission pipe work replacing the conventional sweepolet design. The insert weldolet would offer the following benefits over the traditional version:

1. Shorter Installation time, and hence reduced costs, as a result of:
   - A smaller coupon needing to be removed from the carrier pipe (especially for the larger sizes)
   - A shorter length of weld needed to secure the fitting into the carrier pipe (especially for the larger sizes).
   - Easier to perform 100% weld radiography
2. Simpler design and reduced manufacturing costs.
3. Reduce reliance on a small number of suppliers, improving lead time.

Before National Grid can adopt the use of the insert weldolet , there needs to be clear evidence as to the mechanical viability of these designs. This analysis is to be addressed by this programme.

Objective(s)

This study will seek to establish whether the stress concentration factors (SCF) of a number of alternative designs of branch connections are bounded by those used in the pipe work stress analysis code IGEM/TD/12. If so it will provide National Grid with a broader range of potential designs and suppliers of branch connection pipe work than are currently available increasing construction efficiency and reducing costs.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

If the 3D FEA SCFs are comparable with those determined by the methodologies given in the IGEM/TD/12 standard, it will provide evidence that the standard (non FEA) methodologies of SCF determination are appropriate for the newer designs of WICI such as insert weldolets. This will assist in their adoption and use.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

To fully evaluate the currently specified TD/12 SCF methodologies, detailed FEA is required which will give assurance that the insert weldolets can be treated by the same specification methods.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

These standards documents provide the safety, legislative and operational framework for the National Transmission System (NTS) in the UK.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

IFI - £15k

NIA - £21k + £25k = £46k

Project Eligibility Assessment Part 1

There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

Please answer **at least one** of the following:

How the Project has the potential to facilitate the energy system transition:

n/a

How the Project has potential to benefit consumer in vulnerable situations:

n/a

Requirement 2 / 2b

Has the potential to deliver net benefits to consumers

Project must have the potential to deliver a Solution that delivers a net benefit to consumers of the Gas Transporter and/or Electricity Transmission or Electricity Distribution licensee, as the context requires. This could include delivering a Solution at a lower cost than the most efficient Method currently in use on the GB Gas Transportation System, the Gas Transporter's and/or Electricity Transmission or Electricity Distribution licensee's network, or wider benefits, such as social or environmental.

Please provide an estimate of the saving if the Problem is solved (RIIO-1 projects only)

A number of companies are now producing variations on the second design and National Grid would like to be able to use these since they offer the following benefits over the traditional version:

1. Shorter Installation time, and hence reduced costs, as a result of:
   - A smaller coupon needing to be removed from the carrier pipe (especially for the larger sizes)
   - A shorter length of weld needed to be made to weld the fitting into the carrier pipe (especially for the larger sizes)
   - Easier to perform 100% weld radiography
2. Easier to manufacture therefore anticipated to be lower cost items (estimated as £10k per annum)
3. Reduce reliance on a small number of suppliers, improving lead time and reducing vulnerability

These benefits could also be shared across distribution networks, if the project is successful.

Please provide a calculation of the expected benefits the Solution

Base costs per traditional sweepolet branch = £20k per annum
Method Cost of insert weldolet = £10k per annum
(savings on purchase costs only, other benefits are more difficult to quantify at this stage)

Please provide an estimate of how replicable the Method is across GB

The proposed adoption of the insert weldolet will be generic across National Grid.

Please provide an outline of the costs of rolling out the Method across GB.

No additional implementation costs are envisaged as the programme is to determine the suitability of the adoption of a new component.

Requirement 3 / 1

Involve Research, Development or Demonstration

A RIIO-1 NIA Project must have the potential to have a Direct Impact on a Network Licensee's network or the operations of the System

Operator and involve the Research, Development, or Demonstration of at least one of the following (please tick which applies):

☑ A specific piece of new (i.e. unproven in GB, or where a method has been trialled outside GB the Network Licensee must justify repeating it as part of a project) equipment (including control and communications system software).

☐ A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)

☐ A specific novel operational practice directly related to the operation of the Network Licensees system

☐ A specific novel commercial arrangement

RIIO-2 Projects

☐ A specific piece of new equipment (including monitoring, control and communications systems and software)

☐ A specific piece of new technology (including analysis and modelling systems or software), in relation to which the Method is unproven

☐ A new methodology (including the identification of specific new procedures or techniques used to identify, select, process, and analyse information)

☐ A specific novel arrangement or application of existing gas transportation, electricity transmission or electricity distribution equipment, technology or methodology

☐ A specific novel operational practice directly related to the operation of the GB Gas Transportation System, electricity transmission or electricity distribution

☐ A specific novel commercial arrangement

Specific Requirements 4 / 2a

Please explain how the learning that will be generated could be used by the relevant Network Licensees

The programme will clarify the SCF determination methodologies for all available branch components and is available to any relevant licensee.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

The programme aims to deliver considerable benefits in optimising asset management within the Reliability theme. There is also direct correlation with the Strategic theme.

☑ Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

Is the default IPR position being applied?

☑ Yes

Project Eligibility Assessment Part 2

Not lead to unnecessary duplication

A Project must not lead to unnecessary duplication of any other Project, including but not limited to IFI, LCNF, NIA, NIC or SIF projects already registered, being carried out or completed.

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

n/a

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

n/a

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

n/a

Relevant Foreground IPR

n/a

Data Access Details

n/a

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

n/a

Please identify why the project can only be undertaken with the support of the NIA, including reference to the specific risks(e.g. commercial, technical, operational or regulatory) associated with the project

n/a

This project has been approved by a senior member of staff

☑ Yes