

A large offshore oil platform is illuminated at night, with a bright flare burning at the top. The platform's lights reflect on the dark water. In the background, another smaller vessel is visible on the horizon under a cloudy night sky.

production technology services
for the oil & gas industry

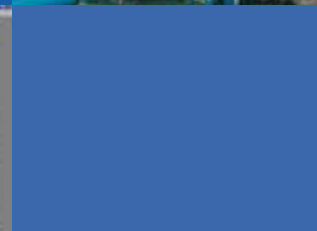
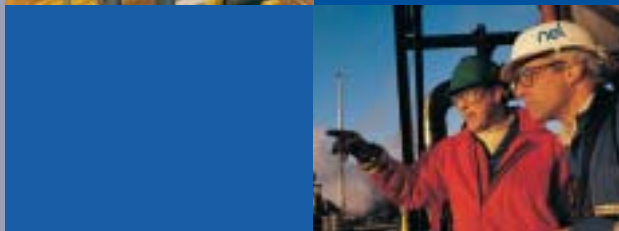
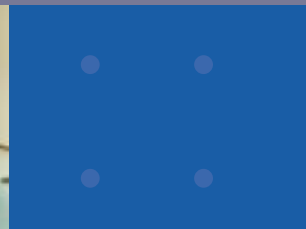
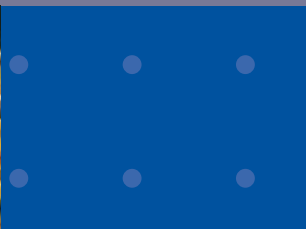
www.tuvnel.com

nel
oil & gas services


providing production technology services for the oil & gas industry

nel has a successful track record spanning over three decades of service to the oil & gas industry. We are a leading provider of consultancy, on-site and laboratory services to the international petroleum industry. We work with our clients to decrease operational costs and reduce capital expenditure by offering services appropriate to their specific needs. From the Gulf of Mexico to the North Sea Shelf, from the deserts of the Middle East to the jungles of Malaysia **nel** has played a role.

Innovative technology is crucial to the cost-effective development of oil & gas fields. As oil & gas production moves more increasingly into marginal fields, deeper waters and mature assets, then technology must adapt and be applied accordingly. **nel** has an impressive track record in the development, design and application of leading-edge technology in order to reduce production costs and increase profitability.



consultancy • on-site services • development • testing & evaluation



To assist you in facing the technological challenges in your business, we deliver a portfolio of consultancy, training, on-site and laboratory services in the following areas:

- **flow measurement**
- **environmental measurement**
- **process engineering**
- **thermal engineering**

Our production technology services include:

- Feasibility and conceptual design studies
- Equipment selection, design and sizing
- Thermodynamic calculations
- Vendor bid technical evaluation
- Factory acceptance tests
- Installation advice
- Field acceptance tests
- Independent technical representation
- Specialist consulting:
 - Export and allocation metering
 - Multiphase and wet gas metering
 - Pumps and valves
 - Heat exchangers
 - Oil-in-water monitors
 - Produced water systems
 - Fluid properties
- Calibration services
- Oil, water and gas flow tests
- Multiphase and wet gas flow tests
- Flow and thermal modelling
- Computational fluid dynamics
- Finite element analysis
- Bespoke software
- Flow metering uncertainty studies
- Measurement data validation
- Failure analysis
- Flow surveys
- Sand management, erosion testing and analysis
- Process fouling analysis
- Umbilical chemical compatibility
- Joint Industry Project management
- Training courses and seminars

● modelling ● training ● joint industry projects

nel
oil & gas services

Our People

People are our main asset. Like your business, it's people that make the difference at **nel**. Our people have a global perspective that is increasingly important for oil & gas exploration, development, and production. The **nel** team are available round the clock to assist our clients from Houston to Singapore, Aberdeen to Lagos... **we are at your service.**

Our Promise

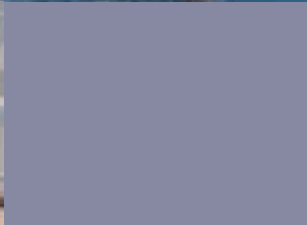
nel is independent of manufacturers, service companies and end users. We offer complete impartiality in all our business dealings. We are frequently called upon by our clients to provide independent technical review, expert witness and due diligence services where complete confidentiality is respected and integrity is of utmost importance.

Aberdeen Abu Dhabi Athens Baku Bangkok Beijing Boulder Boulogne Bratislava Bucharest Budapest Buenos Aires Cairo

Danvers Divina Edenvale Fareham Glasgow Guangzhou Houston Hong Kong Istanbul Kolding Kuala Lumpur Ljubljana

London Madrid Manila Milan Minneapolis Monterrey Moscow Mumbai Munich Osaka Paris Port Elizabeth Posnan Prague Pusan

San Diego Santa Clara Sao Paulo Seoul Shanghai Singapore Stara Zagora Swindon Taipei Thun Tokyo Veldhoven Vienna



ABRASIVE FLOW TEST FACILITY

Erosion problems cost the oil & gas industry many millions of pounds every year. Excessive wear results in downtime, increased maintenance and production cutbacks. Testing vulnerable components in realistic and under accelerated erosive conditions is a key requirement to help understand the erosion process. NEL's abrasive flow test facility can accurately reproduce the wear seen in sandy production flows and in drilling applications.

The safe operation of components is assured through a combination of testing, modelling and interpretation of results. NEL tests components by using a variety of fluid-sand mixtures under realistic operating conditions in a dedicated flow loop at NEL's site. The test results can then be supplemented by CFD (computational fluid dynamics) modelling, FEA (finite element analysis) and alternative erosion prediction methods. This gives an even more accurate assessment of the product performance and expected operating life.

Chokes, valves, wellheads, pipework and other components can now be safely tested and evaluated to ascertain their life expectancy and operational limits.

Expertise has been developed by testing a wide range of components including:

- Hydrocyclones
- Flexible Hoses
- Material Coatings
- Flowmeters
- Flow Restrictors
- Choke Valves
- Isolation Valves
- Piping Configurations

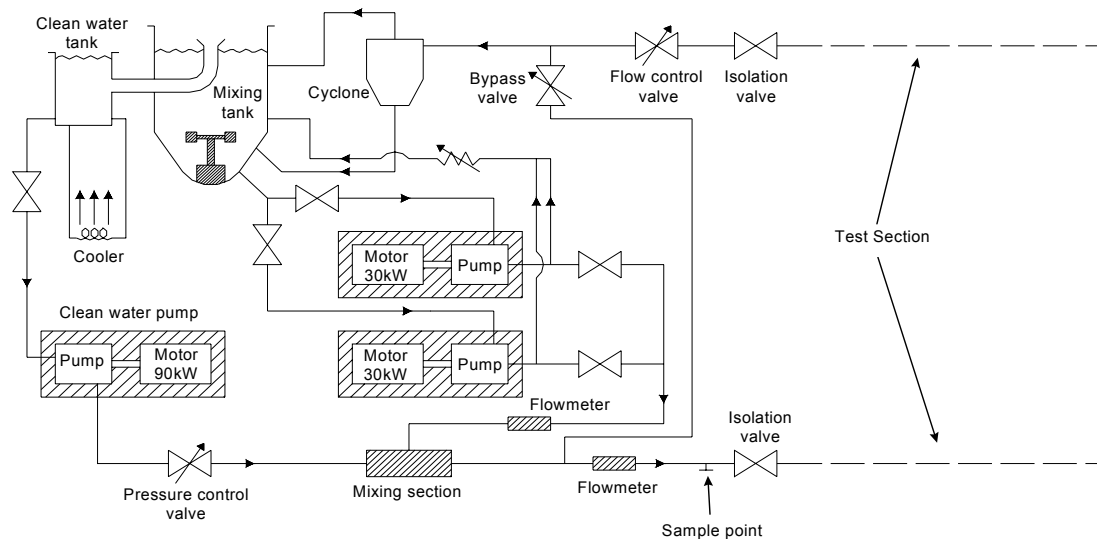
Typical testing regimes include:

- Type Testing
- Endurance Testing
- API 6AVI Slurry Testing
- Cyclic Valve Testing

Benefits of abrasive flow testing, modelling and interpretation include:

- Reduced Failure Rate
- Validated design for Erosive Conditions
- Optimised Prototype Assessment
- Improved Interpretation of Sand Monitor Data
- Increased Information on Failure Mechanisms
- More Confident Assessment of Erosion in Production Systems
- Optimised Inspection & Maintenance Regimes





Technical Specification

	Low Flow Loop	High Flow Loop
Pipe sizes	50 mm nb	100, 150 mm nb
Flowrate	up to 8 l/s	up to 50 l/s
Line Pressure (flowing)	up to 28 bar	up to 14 bar
Test section hydrostatic pressures	up to 1000 bar	up to 50 bar
Temperature	10 to 40°C	10 to 70°C
Sand content % by weight	up to 5%	up to 1.5%



Badly scored - from a ball valve after 1000 cycles, with 0.1% sand



The remains of a stainless steel liner after only a short test



Severe sand erosion in a control valve

For all enquiries, please contact:

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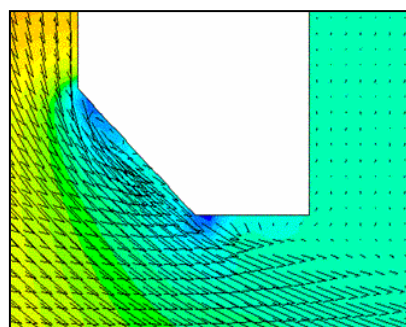


CFD FLOW MODELLING

Computational Fluid Dynamics (CFD) flow modelling is a powerful technique which is used to predict the detailed three-dimensional behaviour of liquid, gas and multiphase flows through pipework and process components. NEL has been at the forefront of applying CFD to study industrial flow processes for over 20 years. We excel at combining practical test and field experience with a well-developed appreciation of the merits and limitations of CFD modelling to produce practical solutions to challenging problems.

Flowmetering

We have a long history of using CFD to predict flow measurement errors caused by upstream pipework, poor installations and non-ideal conditions. Applications have included:



- Orifice plates, Venturis, ultrasonic meters, turbine meters & electromagnetic meters
- Flow conditioners and flow straighteners
- Multiphase and wet gas flows
- Assessment of roughness effects, manufacturing tolerances and contaminant build up

Erosion & Sand Management

NEL has shown that CFD modelling can provide valuable insights into erosion and sand management problems in oil & gas production and drilling applications:

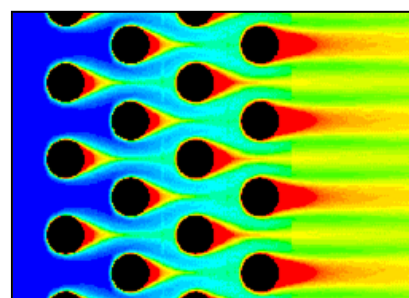


- Erosion of elbows, Xmas trees, wellheads, manifolds, flowlines, chokes & downhole installations
- Cavitation erosion in chokes and valves
- Downhole and surface sand, proppant and cuttings transport
- Desander optimisation
- Sand settling in separators

Thermal Engineering

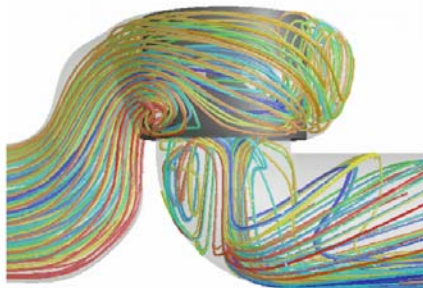
We have successfully utilised CFD in a number of thermal management studies:

- Subsea insulation design
- Heat exchanger modelling
- Pipework & well cool-down calculations



Process & Environmental Engineering

At NEL we have used CFD to study a wide range of process engineering problems both onshore and offshore:

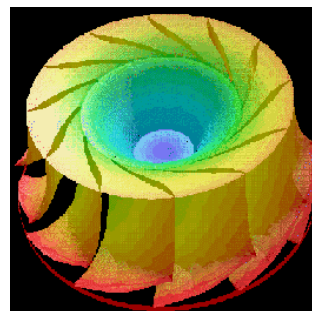


- Separator and demister performance prediction
- Valve failure studies
- Design of water disinfectant devices
- Incinerator emissions calculations
- Emission dispersion predictions
- Reactor vessel residence time predictions
- Combustion modelling

Energy Generation & Clean Energy

NEL has performed a wide range of studies for clients in the power generation sector:

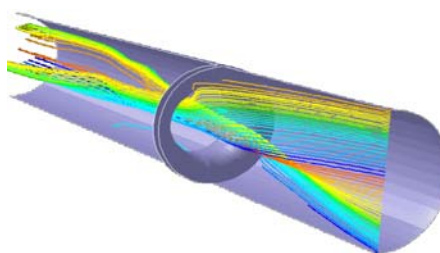
- Hydro turbine fish-kill predictions
- Wind yield predictions in urban areas
- Fuel cell design
- Nuclear clean-up operations



Other Applications of CFD

CFD can simulate many industrial flows and has an incredibly diverse range of potential applications. It can be a complement or an alternative to laboratory testing or field trials. In particular it can assist in understanding unexplained flow behaviour or scaling laboratory data to field conditions.

At NEL we have a long track record of using CFD to produce practical solutions to new and difficult industrial problems.



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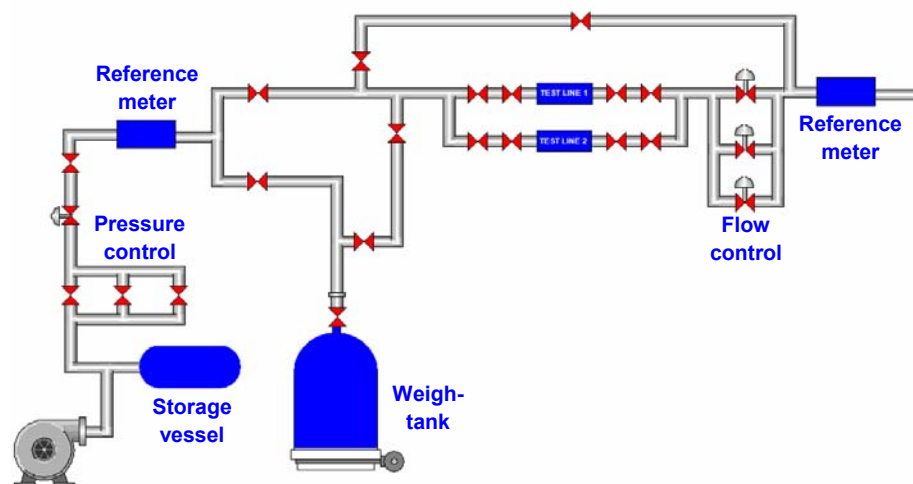


GAS FLOW TEST FACILITIES

NEL has long been recognised as a world renowned authority on flow measurement technology, R & D and calibrations. This reputation has been built up through decades of research and testing in NEL's flow facilities, combined with an active role in the development of many national and international flow measurement standards.

NEL's gas flow measurement facilities comprise several individual facilities which, combined, offer a wide range of flow ranges, line sizes and operating conditions. NEL operates the UK primary standard gravimetric gas flow standard, together with several other facilities directly traceable to national standards. All facilities are accredited by UKAS (United Kingdom Accreditation Service), an independent 3rd party body.

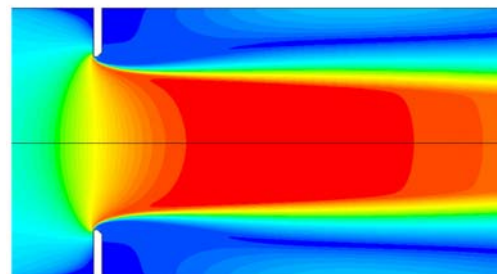
The test sections can be constructed to offer long straight lengths upstream or, if necessary, specific configurations designed to replicate actual installations. The facilities are all housed in a dedicated testing building, providing a comfortable and safe working environment.



Gas Flow Measurement Applications

Gas flow measurement is a much more challenging measurement than that of liquid flow, particularly when high accuracy is required.

In the oil and gas industry, fiscal accuracy requires high quality meter calibrations to minimise financial exposure to the operating companies and to ensure that the appropriate tax revenues are determined.



Gas flow velocity through an orifice plate

In many other industries, there is an equally important need for accurate gas measurement and control, from process control in fine chemicals or pharmaceuticals production to power station burner efficiency optimisation. Furthermore, safety is crucial in pressurised gas systems, requiring knowledge of safety pressure relief valve discharge performance.

Testing Services

- UKAS accredited gas meter calibrations
- Gas flowmeter performance evaluation
- Gas flowmeter development testing
- Installation effects testing
- Flow conditioner compliance testing
- Evaluation of Δp through meter / components
- Flow control valve characterisation
- Valve Cv evaluation
- Safety relief valve discharge capacity testing



Facility Services



In addition to the instrumentation and equipment available in the facility, NEL also offers:

- Handling of dangerous goods
- Handling and storage of radioactive sources
- Overhead crane (5 tonnes)
- Power supplies (110VAC, 240 VAC, DC)
- Mains air supply @ 7 bar (100 psi)

Subject to availability, the facilities can be hired on a day rate or per meter basis for short, medium or long term testing. Full details of facility rates are available on request.

Gas Flow Test Facilities Specifications

Gravimetric rig			Recirculating loop		
Gas:	dry air (or any inert gas)		Gas:	nitrogen	
Flowrates:	2 g/s - 4 kg/s		Flowrates:	80 - 1400 am ³ /hr	
Pressure:	0 - 60 barg		Pressure:	0 - 63 barg	
Temperature:	ambient		Temperature:	15°C - 25°C (± 0.2°	
C)					
Reference:	gravimetric/sonic nozzles		Reference:	turbine / ultrasonic	
Line size:	½" - 8"		Line size:	2" - 8"	
Line length:	15m		Line length:	15m	
Uncertainty:	0.25%		Uncertainty:	0.35%	
Fan lines			Low flow:		
gravi	Califlow				Small
Gas:	air/N2	ambient air	Gas:	air	
Flowrates:	600 - 14,500 m ³ /hr		Flowrates:	0.5 to 5 g/s	0.02 - 45 l/
min					
Pressure:	0 - 5 bar	atmospheric	Pressure:	0 - 7 barg	
Temperature:	ambient	ambient	Temperature:	ambient	
Reference:	orifice / Venturi		Reference:	gravimetric	piston prover
Line size:	4" - 20"		Line size:	¼" -	
2"	¼" - 2"				
Line length:	20m		Line length:	2m	
2m					

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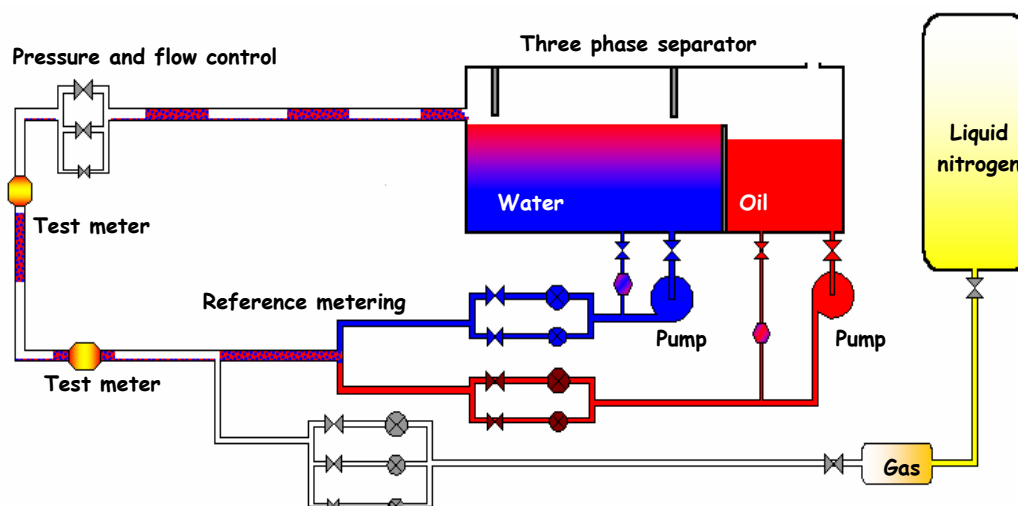
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MULTIPHASE TEST FACILITY

NEL has long been recognised as a world leading supplier of multiphase test and evaluation services. NEL'S multiphase facility is a purpose built facility designed to simulate full three-phase flows encountered in the oil and gas production industry. The facility is designed to enable testing and evaluation of the new production technologies required in today's production situations. Our multiphase testing facility is fully independent and traceable to national measurement standards. The facility is operated by highly skilled operators supported at all stages by technical experts to ensure that our customers receive the best possible service, matching their expectations throughout the process.

The facility is built around a full-scale three-phase separator, which separates and stores the oil and water phases, with the gas phase supplied on demand. Each phase is pumped and measured separately before being mixed into a multiphase flow and transported round the facility. The two test sections can be constructed to offer horizontal, vertical or inclined piping configurations to match the customer's requirement. The facility is completely enclosed in a state of the art dedicated testing building, providing a comfortable and safe working environment.



Multiphase Metering- the Way Forward

Multiphase meters have developed significantly in recent years, driven by the technical and economic requirements of new marginal field developments.

NEL has been heavily involved in all stages of multiphase meter development. Through extensive Joint Industry Projects and 3rd party testing programmes NEL has tested virtually all multiphase meters currently on the market or deployed in the field.



Continued development, testing and evaluation of multiphase meters is essential to improve their performance (5% uncertainty in 10,000 bbl/day oil production equates to approximately \$5 million in financial exposure per year) and reduce costs, enabling per well metering.

Testing Services Offered

- Detailed multiphase flowmeter evaluation
- Multiphase flowmeter FATs
- Water cut monitor evaluation
- Coriolis “Net Oil” evaluation
- Multiphase pump testing
- Compact separator efficiency evaluation
- Interface level detector testing
- 2 and 3-phase effects on single phase meters
- Evaluation of Δp through components
- Valve performance characterisation



Facility Services



In addition to the instrumentation and equipment available in the facility, NEL also offers:

- Handling of dangerous goods
- Handling and storage of radioactive sources
- Overhead crane (10 tonnes)
- Power supplies (110VAC, 240 VAC, DC)
- Mains air supply @ 7 bar (100 psi)

Subject to availability, the NEL facility can be hired on a day rate basis for short, medium or long term testing. Full details of facility rates are available on request.

Multiphase Test Facility Specifications

Fluids/Flowrates

Crude oil (North Sea, API 30)
Salt water (salinity as required)
Nitrogen gas
Gas volume fraction (GVF)
Water cut (WC)

up to 100 m³/hr (15,000 bpd) (uncertainty < 1.0%)
up to 100 m³/hr (15,000 bpd) (uncertainty < 1.0%)
up to 1500 Sm³/hr (1.3 mmscfd) (uncertainty < 1.5%)
0% to 100%
0% to 100%

Operating Conditions

Line pressure
Line temperature
Line sizes
Horizontal line length
Vertical line height

up to 10 barg (145 psig)
5°C to 40°C (40°F to 104°F)
1-inch to 6-inch
60m (30m available test section)
10m

Reference Instrumentation

Oil 1 ¼" and 3" turbine meters
Water 1 ½" and 3" turbine meters
Gas ½", 1" and 3" turbine meters
Cross contamination monitors
Fluid sampling

Test Section Instrumentation

Temperature, pressure
Perspex viewing sections
Gamma densitometer
Video cameras
Mixing (static or powered)
High speed Dp/ pressure logging

Offline Instrumentation

Density measurement
Viscosity measurement
Oil/ water analysis
Gamma densitometer

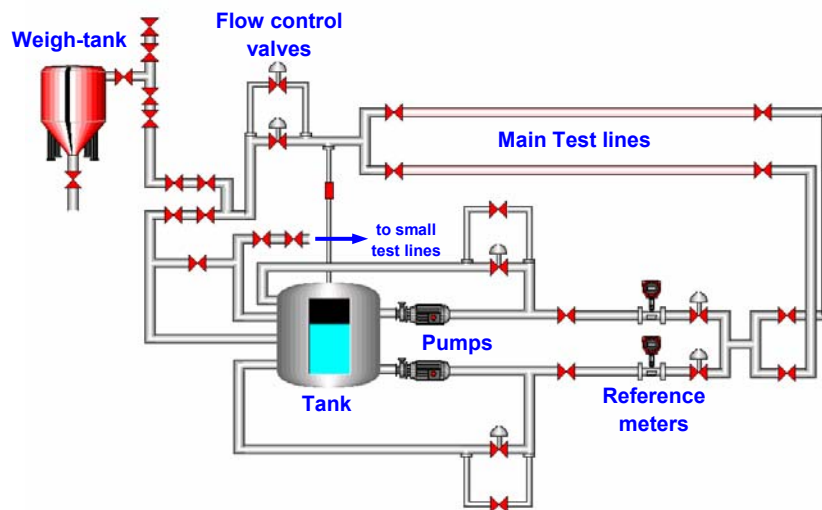
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OIL FLOW TEST FACILITY

NEL is recognised as a world renowned authority on flow measurement technology, R & D and calibrations. This reputation has been built up through decades of research and testing in NEL's flow facilities, combined with an active role in the development of many national and international flow measurement standards.

NEL's oil flow measurement facility is a modern purpose built flowmeter calibration and evaluation facility. The facility has four separate flow lines, covering a wide range of flowrates with a selection of three different oils. Combining these oils with NEL's unique temperature control system allows independent variation in the test temperature and viscosity. The test sections can be constructed to offer long straight lengths upstream or, if necessary, specific configurations designed to replicate actual installations.

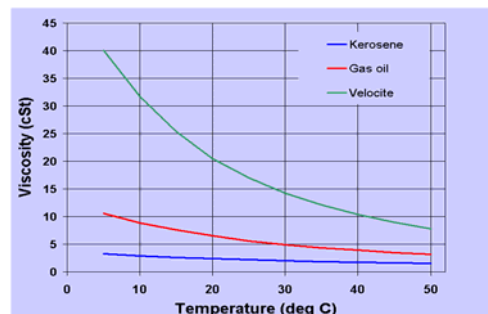
NEL operates the UK primary standard oil flow standard, which is independently accredited by UKAS (United Kingdom Accreditation Service), an independent 3rd party body. The facility is operated by multi-skilled teams supported by technical experts. The facilities are all housed in a state of the art testing building, providing a comfortable and safe working environment.



Oil Flow Measurement Applications

Accurate oil flow measurement is one of the most important requirements in the oil and gas industry. In fiscal metering, an additional 0.03% uncertainty in 50,000 bbls/day results in an increased exposure of more than \$100,000 in one year alone.

The fluid viscosity can also have an impact on the measurement performance of some meter technologies.



Viscosity ranges of oils in NEL facility

Many types of flowmeters are affected by installation effects for example bends, valves or headers upstream of the meter. This can result in significant errors in the measured flow which, if used for fiscal or allocation purposes, can result in very significant financial exposure to those involved.

Testing Services

- UKAS accredited oil meter calibrations
- Oil flowmeter performance evaluation
- Evaluation of temperature / viscosity effects
- Installation effects testing
- Oil flowmeter development testing
- Flow conditioner compliance testing
- Evaluation of Δp through meter / components
- Flow control valve characterisation
- Valve Cv evaluation



Facility Services



In addition to the instrumentation and equipment available in the facility, NEL also offers:

- Handling of dangerous goods
- Handling and storage of radioactive sources
- Overhead crane (5 tonnes)
- Power supplies (110VAC, 240 VAC, DC)
- Mains air supply @ 7 bar (100 psi)

Subject to availability, the facilities can be hired on a day rate or per meter basis for short, medium or long term testing. Full details of facility rates are available on request.

Oil Flow Test Facilities Specifications

Oils and properties	Density range (kg/m ³)	Viscosity range (cSt)
Kerosene	780 to 810	1.5 to 3
Gas oil	805 to 835	3 to 10.5
Lubricating oil	825 to 855	8 to 40.0
Operating conditions		
Flowrates:	0.05 l/s to 200 l/s (approx. 30 bbl/day to 105,000 bbl/day)	
Line pressure:	0 to 5 bar (72 psi)	
Line temperature	5 to 45°C (controlled to < 1°C)	
Line sizes	1-inch to 8-inch	
Horizontal line length	25m	
Vertical line height	5m	
Reference		Uncertainty
Primary gravimetric standard:	6t, 1.5t, 600kg, 150kg weigh-tanks	0.03%
Secondary standard:	2 off 5" turbine meters	0.08%
Test Instrumentation		Offline Instrumentation
Temperature, pressure, Δp		Density measurement
High speed Δp / pressure		Viscosity measurement
Velocity profiling Pitot traverse system		
Note: 1) Test sections can be constructed with bends, valves etc to replicate specific installations.		
2) Gas injection into oil flow test sections is also possible to assess gas breakout effects.		

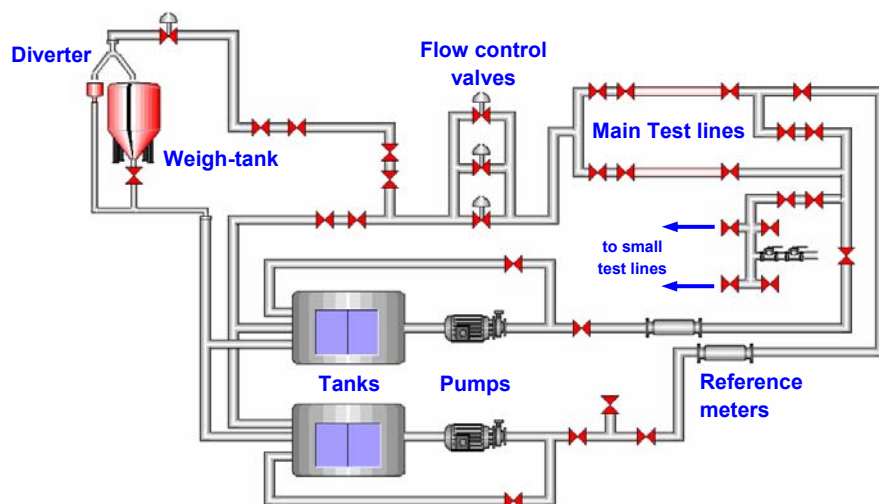
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WATER FLOW TEST FACILITY

NEL is recognised as a world renowned authority on flow measurement technology, R & D and calibrations. This reputation has been built up through decades of research and testing in NEL's flow facilities, combined with an active role in the development of many national and international flow measurement standards.

NEL's water flow measurement facility is a modern purpose built flowmeter calibration and evaluation facility. The facility has four separate flow lines, covering a wide range of flowrates in different line sizes. The test sections can be constructed to offer long straight lengths upstream or, if necessary, specific configurations designed to replicate actual installations.

NEL operates the UK primary standard water flow standard, which is independently accredited by UKAS (United Kingdom Accreditation Service), an independent 3rd party body. The facility is operated by multi-skilled teams supported by technical experts. The facilities are all housed in a state of the art testing building, providing a comfortable and safe working environment.



Water Flow Measurement Applications

Accurate water flow measurement is a key requirement in many industries. In the water industry, the increasing value of potable water around the world requires more accurate measurements and leakage detection.

In the process industry, use of water in manufacturing and production is coming under increasing efficiency pressures with an associated requirement for accurate measurement.

In the oil and gas industry, many mature oil fields are producing large amounts of water along with the target oil, most of which is discharged back to the sea following treatment to reduce the oil content. A recent estimate put this volume at 1.3 million cubic meters per day in the North Sea alone. Legislation is currently being introduced to reduce these discharges, however these can only be effective if the volumes can be measured reliably.



Testing Services

- UKAS accredited water meter calibrations
- Water flowmeter performance evaluation
- Evaluation of temperature effects
- Installation effects testing
- Water flowmeter development testing
- Flow conditioner compliance testing
- Evaluation of Δp through meter / components
- Flow control valve characterisation
- Valve Cv evaluation



Facility Services



In addition to the instrumentation and equipment available in the facility, NEL also offers:

- Handling of dangerous goods
- Handling and storage of radioactive sources
- Overhead crane (5 tonnes)
- Power supplies (110VAC, 240 VAC, DC)
- Mains air supply @ 7 bar (100 psi)

Subject to availability, the facilities can be hired on a day rate or per meter basis for short, medium or long term testing. Full details of facility rates are available on request.

Water Flow Test Facilities Specifications

Fluids/flowrates

Water (clean treated) 0.05 l/s to 400 l/s (approx. 0.2 m³/hr to 1400 m³/hr)

Operating conditions

Line pressure: 0 to 5 bar (72 psi) up to 400 l/s
0 to 10 bar (145 psi) up to 200 l/s
Line temperature 10 to 40°C (controlled to < 1°C)
Line sizes 1-inch to 10-inch
Horizontal line length 25m
Vertical line height 5m

Reference

Primary gravimetric standard:	12t, 1.5t, 300kg weighbridges (to 200 l/s)	Uncertainty 0.08%
Secondary standard:	Reference turbine meters (to 400 l/s)	0.15%

Test Instrumentation

Temperature, pressure, Δp
High speed Δp / pressure
Velocity profiling Pitot traverse system

Offline Instrumentation

Density measurement
Viscosity measurement

Note: 1) Test sections can be constructed with bends, valves etc to replicate specific installations.
2) Gas injection into water flow test sections is also possible to assess gas breakout or cavitation effects.

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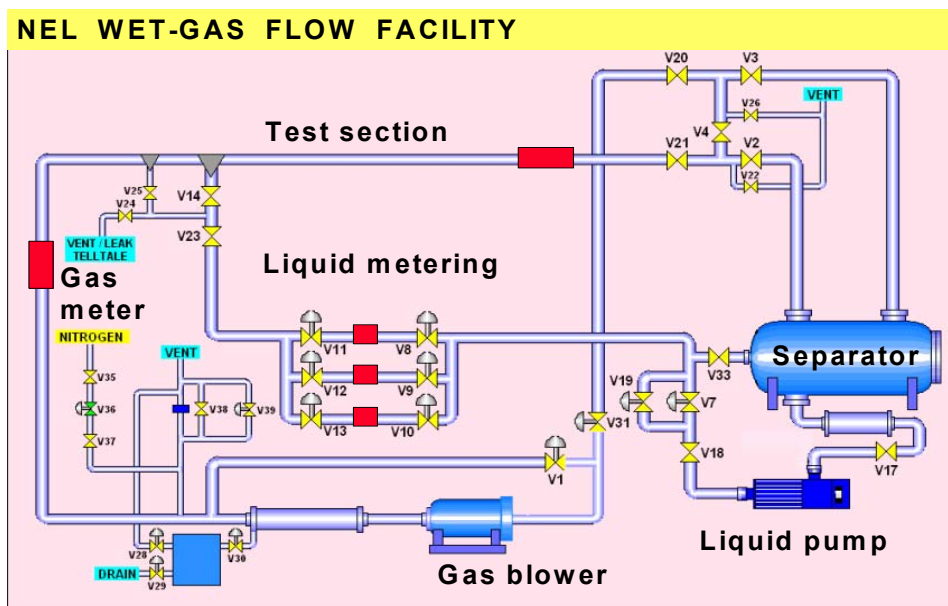
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WET GAS TEST FACILITY

NEL has long been recognised as a world leading supplier of multiphase test and evaluation services. The Wet Gas Test Facility now extends this service into the very high gas fraction region, an area of increasing significance in the oil and gas industry. The facility is operated by highly skilled operators supported at all stages by technical experts to ensure that our customers receive the best possible service, matching their expectations throughout the process.

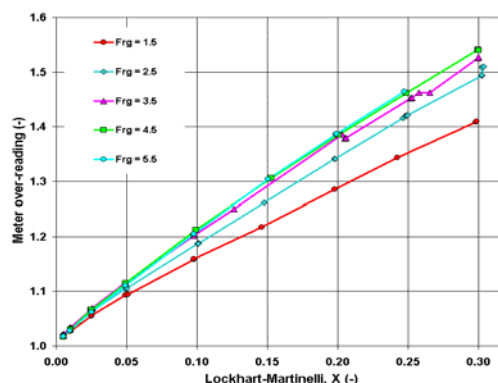
The Wet Gas Test Facility is designed to simulate gas flows with small quantities of liquids present, such as found in gas/condensate and very high GOR fields. The facility is built around a high pressure gas/liquid separator, which stores the working fluids. Each phase is pumped and metered separately prior to mixing. Two test lines are available with horizontal and vertical configurations to suit the equipment under test. The facility is completely enclosed in a dedicated testing building, providing a comfortable and safe working environment.



Wet Gas Metering

Applications of wet gas metering have increased in recent years, particularly in allocation or even fiscal metering for newly developed marginal gas fields.

This requires a good understanding of the effect of liquid on gas meters. Just 0.5% liquid by volume in the gas stream can cause up to 10% error in gas measurement. If not accounted for this can lead to large allocation errors.



Effect of liquid on Venturi meter gas measurement

A 2% error in a 50 mmscf/d gas field could result in over £1/2 million equity exposure per year. This exposure can be reduced by testing the meters in wet gas to determine the correction required prior to deployment.

Testing Services

- Detailed wet gas meter evaluation
- Wet gas meter FATs
- High GVF multiphase meter evaluations
- Wet gas Venturi characterisation
- Two-phase effects on dry gas meters
- Compact separator performance evaluation
- Wet gas sampling system testing
- Liquid detection monitor testing



Facility Services



In addition to the instrumentation and equipment available in the facility, NEL also offers:

- Handling of dangerous goods
- Handling and storage of radioactive sources
- Overhead crane (10 tonnes)
- Power supplies (110VAC, 240 VAC, DC)
- Mains air supply @ 7 bar (100 psi)

Subject to availability, the facility can be hired on a day rate basis for short, medium or long term testing. Full details of facility rates are available on request.

Wet Gas Test Facility Specifications

Fluids/Flowrates

Gas (nitrogen)
Liquid (kerosene or water)
Uncertainty

Up to 1400 m³/hr
0% to 10% by volume
Gas flow < 0.5%
Liquid flow < 0.2%

Operating conditions

Line pressure
Line temperature
Line sizes
Horizontal line length
Vertical line height

0 to 63 bar (910 psi)
15 to 25°C (controlled to 0.2°C)
2-inch to 8-inch
15m
10m

Reference Instrumentation

Gas 6" ultrasonic and turbine meters
Liquid ½", 1" and 3" turbine meters

Test Instrumentation

Temperature, pressure, Δp
High speed Δp / pressure
Subsea visualisation camera
Gamma densitometer

Offline Instrumentation

Density measurement
Viscosity measurement

For all enquiries, please contact:

NEL, East Kilbride, GLASGOW, G75 0QU, UK

Tel: +44 1355 220222 Fax: +44 1355 272999

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National Standard Flow Measurement Facilities

NEL is one of the foremost authorities on fluid flow measurement in the world today. The comprehensive test facilities operate with water, gas, oil and mixtures of all three fluids. NEL, supported by DTI, is responsible for the provision and maintenance of the national standards for flow measurement of these fluids, as well as for density measurement. NEL is therefore at the top of the UK flow measurement chain for oil, gas and multiphase flow.

The facilities can accommodate all types of flowmeters, for example turbine, ultrasonic, electromagnetic, Coriolis meters, Venturi, sonic nozzles and other DP devices. For more than 40 years NEL has carried out many R&D projects on the performance of these meters under various operational conditions and so has considerable experience to enable interpretation of calibration results. The added value of an **independent** assessment of customers' equipment is a prime reason for choosing NEL rather than using a cheaper, non-accredited laboratory or relying solely on a manufacturer's check.

The benefits of NEL calibration include:

- lowest uncertainty of reference measurements
- clear description of method used
- regularly UKAS assessed facilities ensuring consistent high quality
- reference devices and secondary instrumentation are calibrated at UKAS-accredited laboratories with appropriate documented uncertainties
- confidence in the accuracy of the calibration
- results verified by a technical expert

The table below provides a summary of capacities and best measurement uncertainties of the national standard facilities.

Facility	Capacity	Uncertainty of reference measurements
* Water	10 l/hr – 400 l/s	0.1 - 0.2%
* Gas	0.3 ml/s - 1,600m ³ /hr to 70 bar	0.1 - 0.5%
* Oil	0.04 – 200 l/s viscosities from 2 - 30 cSt	0.03 - 0.08%
Multiphase	0.5 kg/s gas flow 40 l/s oil flow 40 l/s water flow to 10 bar	< 1.5% < 0.5% < 0.5%
Density	liquid: -40 – 150 °C to 300 bar gas: -40 – 150 °C 12 to 300 bar	0.01% 0.02%

* UKAS accreditation No 0009

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TUV NEL Ltd operate a Quality Management System certified to ISO 9001:2000

nel



courses, conferences and seminars
inspiring knowledge

www.tuvnel.com

nel
technology transfer

providing knowledge solutions to industry

Any investment you make in training and staff development must deliver tangible returns. Feedback received from delegates shows that the knowledge gained from NEL events actually leads to cost reductions, process and performance improvements, and safety enhancements.

NEL organise a range of events:

- Seminars
- Workshops
- Conferences
- Training Courses


These events focus on technological and legislative issues and are targeted within the oil & gas, process, automotive, utilities, defence and government sectors. Attendees at the events share best-practice, disseminate the latest thinking, and engage in networking and lively debate.

The quality of events organised by NEL is world-renowned: many companies book multiple places knowing that the experience will be beneficial and prove to be value for money.



Training courses can be designed to range from one-day basic courses up to five-day intensive training and can be at fundamental or in-depth levels. Training can be held at your premises, at NEL, or at specially chosen venues around the world.

In addition to classroom-based training, NEL is in the unique position of having some of the world's most comprehensive test machinery and equipment for water, oil and gas flow measurement as well as facilities for structural and thermal work. These practical areas allow delegates to have hands-on experience and access to demonstrations that replicate real-life situations.



Managing resources is the most effective route to maximising their effectiveness. Knowledge and technology are resources which can deliver tangible benefits in terms of improved competitiveness, responsiveness and innovation.

NEL also manage a number of carefully targeted activities to ensure that the 'implementation' stage of learning is successful.

These activities include:

- Seminars
- Workshops
- Conferences
- Training Courses
- Clubs
- Focus Groups
- Committees
- Consultancy
- Websites
- Newsletters
- Programme Management

- NEL-organised seminars, workshops and conferences include best-practice guidance, case studies and interactive sessions, allowing delegates to learn from experts, and benefit from their experience.
- The presenters are all experts in their specialised areas and many are recognised as world authorities in their chosen subjects. NEL staff members are joined by key players from industry to give delegates the benefits of their knowledge and field experiences.
- Many of the events can be tailored to specific company requirements. This ensures that delegates benefit from the latest thinking and that the material is directly relevant to their working environment. At in-house events participants can openly discuss real work issues without the limitations of commercial confidentiality.
- A combination of technical presentations, interactive sessions and delegate participation enables knowledge to be successfully transferred between individuals and organisations.

NEL has a successful track record spanning over half a century serving industry. We are a leading provider of services, solutions and technology to an international customer base across a variety of industry sectors. We work with our clients to decrease operational costs and reduce capital expenditure by selecting solutions and technologies appropriate for their specific needs.

Employing over 100 professionals at the leading-edge of technology, NEL has an international track record in key technologies such as flow measurement, process engineering and fluid properties. This gives NEL an enviable capability to present material which is complemented by input from our global network.

NEL is part of TÜV SÜD Group, the global technical services company serving customers in a wide range of industries. With more than 125 years experience it has developed to become the world's largest independent providers of testing and certification services.

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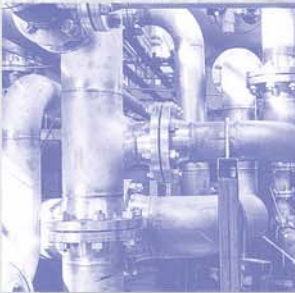
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TUV NEL Enquiry Form

For further details on any of the services detailed, please complete and faxback to **+44 (0) 1355 272999**

Name:

Company:

Address:

Tel:

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Email:

Please tick the service(s) for which you would like further information:

- | | | |
|---|---|----------------------------------|
| <input type="checkbox"/> Facility Information | <input type="checkbox"/> Flow Measurement | <input type="checkbox"/> Wet Gas |
| <input type="checkbox"/> Erosion Modelling | <input type="checkbox"/> Multiphase | |
| <input type="checkbox"/> Training | <input type="checkbox"/> Consultancy | |

If you require any further assistance with a specific flow measurement issue, please give details below and one of our consultants will be in touch to discuss this further: