Robot Inspection and Calibration System
ROBINCA
Robinca

Robot Inspection & Calibration System

Robinca is a portable and versatile measurement system for assessment of pitting, erosion and general wear of gun barrels. It combines visual inspection with highly accurate non-contact measurement technology.

High Resolution
Robinca features reliable Fogale Nanotech technology that combine visual inspection with high resolution and accurate diameter measurements. This complies with standards provided by the barrel manufacturers and/or operating organization, such as TDV018.

Capacitive sensors provide an almost unlimited accuracy (it “sees the first molecule”) and can be specified to measure at micron level. The Robinca system is designed for an accuracy of 5µm, and repeatability better than 1µm. The sensors are solid and contain no moving parts. They are rugged and durable, and are not easily affected by ambient conditions.

Modular Nature
The Robinca is compounded of modules and the software QtBCS contains all relevant gun bores. By switching between caliber specific components, one main unit can be utilized for all gun bores. The modular nature of the system provides increased versatility and cost savings. For the time being the system ranges from 4,6mm rifle barrel to 155mm howitzer. Software user-interface is uniform through the complete range.

Report Generation
The Robinca system automatically generates reports for statistics and analyses instantly after a measurement procedure. The operator can choose between several types of report formats. All measurement data can be imported into GBMS, Gun Barrel Management System, for further analysis.

Safety
Robinca contributes to safety for investments and personnel by discovering developing degradation and by this reducing the risk for accidents. The system contributes to maintain operational precision by improved exit velocity prediction. Robinca reduces the risk of phasing out systems with remaining barrel life or overuse of worn barrels.
Robinca enables management of:
  Operational configuration management
  Logistics – efficient allocation of materials
  Logistics and budget
  Planning and training activities related to barrel life
  Overall life cycle and inventory planning

Robinca features unique measuring and inspection techniques enabling high precision and low measurement error as specified below:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacitive sensors</td>
<td>Very high resolution, non-contact, fast, accurate, environmentally resilient</td>
</tr>
<tr>
<td>Laser line deflection measurement</td>
<td>Non-contact, no moving part, fast, scanning effect</td>
</tr>
<tr>
<td>Camera</td>
<td>Tilt/rotate, internal lights, high resolution and sensitivity</td>
</tr>
<tr>
<td>Laser position unit and crawler</td>
<td>Localizes and recovers damages</td>
</tr>
</tbody>
</table>

Robinca exceeds traditional measurement tools in that it enables accurate diameter measurements to be taken and recorded on top and at the bottom of caliber and groove. It also provides measurements of area and depth as well as longitudinal positioning.

**Feature chart**

<table>
<thead>
<tr>
<th>Caliber</th>
<th>Diameter measurement</th>
<th>Area measurement</th>
<th>Pit erosion</th>
<th>Integrated Camera</th>
<th>Position Laser</th>
<th>Software QtBCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>155mm</td>
<td></td>
<td>v</td>
<td>v</td>
<td>v</td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>120mm</td>
<td></td>
<td>v</td>
<td>v</td>
<td>v</td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>120mm chamber</td>
<td></td>
<td>v</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>105mm</td>
<td></td>
<td>v</td>
<td>v</td>
<td>v</td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>30mm</td>
<td></td>
<td>v</td>
<td></td>
<td></td>
<td>v</td>
<td></td>
</tr>
<tr>
<td>12,5mm</td>
<td></td>
<td>v</td>
<td>v</td>
<td></td>
<td>v</td>
<td></td>
</tr>
<tr>
<td>7.62mm</td>
<td></td>
<td>v</td>
<td>v</td>
<td></td>
<td>v</td>
<td></td>
</tr>
<tr>
<td>5.56mm</td>
<td></td>
<td>v</td>
<td>v</td>
<td></td>
<td>v</td>
<td></td>
</tr>
<tr>
<td>4.60mm</td>
<td></td>
<td>v</td>
<td>v</td>
<td></td>
<td>v</td>
<td></td>
</tr>
</tbody>
</table>

Calibers of other dimensions are quoted on request.
This probe is used for assessing smooth bore Leopard 2 Gun Barrel. It combines visual inspection with non-contact measurement methods.

According to standards supplied by the barrel manufacturers and/or operating organizations, diameter increase, pitting depth and damaged area of chromium plating must be documented. In order to comply with these standards the measurement probe is equipped with laser line deflection as well as capacitive sensors.

The Robinca 120mm measurement probe consists of a camera, a crawler and a measurement head. The camera and the electrical crawler are connected to the 120mm Robinca measurement head and assembled into the alignment sleeve.

The complete assembly is mounted by snap-on clamps onto the muzzle end of the barrel. All cables are connected to the control unit. Area measurement is carried out in the BCSoft software.

The system provides the possibility to perform either barrel and chamber measurement or only either one of the two. The measurement data are automatically stored in data files and visualized as tables and graphs.

Robinca 120mm measurement probe

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The system provides the possibility to perform either barrel and chamber measurement or only either one of the two. The measurement data are automatically stored in data files and visualized as tables and graphs.
Robinca 120mm chamber measurement probe

This probe measures 8 predefined cross-sections in a chamber, as specified in the barrel manufacturer handbook.

Caseless ammunition requires a higher focus on the chamber. An increased diameter larger than 0.05 mm in the rear end should not be allowed according to standard.

Rolling balls situated all the way around the probe body ensures easy and safe insertion and rotation, either in the calibration ring or in the chamber.

The measurement probe is rotated manually according to instructions from the QtBCS software. Pictures can be imported into the report.

A certified calibration ring is included. The purpose of this calibration ring is to set the correlation between the capacitive measurement and millimeters prior to a measurement sequence.

Description of use

Robinca measurement probe is inserted into the chamber at rotation 0 degree. The probe has to be turned manually as instructed by the QtBCS.

At the predefined measurement positions, the capacitive sensors collect measurement data from the barrel. Average measurement accuracy is better than +/-20 microns. Repeatability is +/-1 micron. Stored data can be displayed and reports is automatically produced from QtBCS software.

Technical specification

<table>
<thead>
<tr>
<th>Robinca 120mm chamber measurement probe</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Length:</td>
<td>737,7mm</td>
</tr>
<tr>
<td>Weight:</td>
<td>13kg</td>
</tr>
<tr>
<td>Diameter:</td>
<td>Ø158,0mm</td>
</tr>
<tr>
<td>Material:</td>
<td>Anodized aluminium</td>
</tr>
<tr>
<td>Colour:</td>
<td>Black dim</td>
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</table>

Diameter measurement

<table>
<thead>
<tr>
<th>Technology</th>
<th>Capacitive sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of sensors</td>
<td>16</td>
</tr>
<tr>
<td>Accuracy 119 (+/-0)mm</td>
<td>±0,020mm</td>
</tr>
<tr>
<td>Accuracy 158 (+/-0)mm</td>
<td>±0,020mm</td>
</tr>
<tr>
<td>Resolution</td>
<td>±0,002mm</td>
</tr>
</tbody>
</table>

Calibration ring and certificate
These probes used for assessment of erosion and wear of grooved barrels. They combine visual inspection with non-contact capacitive measurement.

According to standards supplied by the barrel manufacturers and/or operating organizations, diameter increase, torn barrel fragments and damaged area must be assessed and documented. In order to comply with these standards the measurement probes are equipped with capacitive sensors.

The Robinca 105mm and 155mm measurement probes consists of a camera, a crawler and a measurement head. The camera and the electrical crawler are connected to the 105mm or 155mm Robinca measurement head and assembled into the alignment sleeve. The complete assembly is mounted by snap-on clamps onto the muzzle end of the barrel. All cables are connected to the control unit. Area measurement is carried out in the QtBCS software. The measurement data are automatically stored in data files and visualized as tables and graphs.

### Technical specification

**Robinca 155mm measurement head**
- Length: 861mm
- Weight: 11kg
- Diameter: Ø154,5mm
- Material: Anodized aluminium
- Colour: Black

**Diameter measurement**
- Technology: Capacitive sensors
- No. of sensors: 8
- Accuracy mm: ±0.005mm
- Accuracy mm: ±0.020mm
- Resolution: ±0.001mm

**Calibration ring and certificate**

**Robinca 105mm measurement head**
- Length: 861mm
- Weight: 6.6kg
- Diameter: Ø104,7mm
- Material: Anodized aluminium
- Colour: Black

**Diameter measurement**
- Technology: Capacitive sensors
- No. of sensors: 8
- Accuracy mm: ±0.005mm
- Accuracy mm: ±0.020mm
- Resolution: ±0.001mm

**Calibration ring and certificate**

### Description of use

See description of the 120mm measurement probe.
Robinca 30mm measurement probe

The probe is manually fed into the barrel by extendable rods. This system measures caliber and groove diameters. A fixed tape measure indicates longitudinal position.

According to requirements set by the barrel manufacturers and/or operating organization, potential diameter increase must be assessed and documented. In order to comply with these requirements the measurement head is equipped with capacitive sensors.

The measurement data are automatically stored in data files and visualized as tables and graphs. Pictures can be imported into the report.

Description of use
Robinca is inserted into the muzzle end of the barrel by extendable rods resting in a tripod mounted crib. The probe is pushed and rotated in the barrel manually according to instructions from the QtBCS software. At the selected measurement positions, the capacitive sensors collect measurement data from the barrel.

Technical specifications
Robinca 30mm measurement head
- Length: 2660mm
- Weight: 19kg
- Diameter: Ø29,9mm
- Material: Stainless steel

Diameter measurement
- Technology: Capacitive sensors
- No. of sensors: 4
- Accuracy @ 0.5mm: ±0.005mm
- Accuracy @ 1.2mm: ±0.050mm

Calibration ring and certificate
Robinca small caliber

The probe is manually fed into the barrel by a single rod. This system measures caliber and groove diameters. A fixed tape measure indicates longitudinal position.

According to requirements set by the barrel manufacturers and/or operating organization, potential diameter increase must be assessed and documented. In order to comply with these requirements the measurement head is equipped with capacitive sensors.

The measurement data are automatically stored in data files and visualized as tables and graphs. Pictures can be imported into the report.

Description of use
Robinca is inserted into the muzzle end of the gun by a single rod. The probe is pushed and rotated in the barrel manually according to instructions from the QtBCS software. At the selected measurement positions, the capacitive sensors collect measurement data from the barrel.
Examples of findings

Same 155mm cannon barrel - brand new and towards wear life time

155mm cannon barrel - copper deposits

30mm cannon barrel - detonation inside
Visual inspections can detect indications that helps an operator to make good decisions in condition monitoring of cannon barrels, engines or turbines.

The Mentor Visual iQ VideoProbe is our most advanced portable, connected digital flexible boroscope with 3D Measurement and remote wireless collaboration. It accurately detects visual findings such as corrosion, cracking, pits and tearing-off parts of a caliber or chromium.

The Mentor Visual iQ combines portability with powerful processing. Meet a variety of inspection needs with interchangeable probes and tip optics. The touchscreen interface enables faster navigation, precise cursor placement, and on-screen typing and annotation to speed up inspections. Designed and tested to recognized civilian and military standards (IP55, MIL-STD-810G and MIL-STD-461F), the device is dependable in the field. And at just 6.75lbs with a lithium-ion battery, the aircraft compliant Mentor Visual iQ stores in overhead compartments for easy mobility.

With Wi-Fi enabled Bluetooth keyboard and headset, inspectors of all levels can work together instantly. Inspectors will be able to share screens and images, gather opinions and even make notes in real time with Inspection Connect—no matter the environment or distance between them.

The images can easily be imported into a Robinca report.

Technical specification

**Mentor Visual iQ VideoProbe**

- **Weight:** From 3,0 kg
- **Diameter probe:** Ø4.0mm, 6.1mm, 8.4mm
- **Waterproof:** 1 bar
- **Image sensor:** 1/6" Color superhad CCD camera
- **Pixel Count:** 440 000 pixels
- **Housing:** Titanium
- **Power:** Lithium Ion Battery, 10.8V
- **Hard button/joystick interface:** Yes
- **IP65/MIL-810 field durability & ruggednes:** Yes
- **QuickChange battery pack:** Yes
- **Connectivity:**
  - Wi-Fi/Bluetooth
  - Network drive mapping
  - InspectionWorks-ready
- **Comparison Measurement:** Yes
- **Model can be upgraded:** Yes
- **Up to 16GB internal memory:** Yes
- **QuickChange probes:** Option
- **Touchscreen interface:** Option
- **3D Phase measurement:** Option
- **Stereo measurement:** Option
- **Probability of Detection Suite:** Option
XLVU VideoProbe

A value priced VideoProbe that combines portability, durability and image quality for general inspection.

The XLVU VideoProbe™ system provides inspectors unparalleled access in a one-piece system that is rugged enough to stand up to field conditions and ready to go anywhere.

• Intuitive, easy-to-use controls
• Servo motor All-Way® Probe articulation
• 2 hour battery life (with optional 4 hour upgrade)
• LED illumination to display excellent image quality
• 1GB Internal Flash memory
• 1 USB® 2.0 port, VGA video out
• Full tip optic interchangeability with secure double threads
• Custom shipping and storage case included with system
• Weighing 1.77 kg (3.90 lb), can easily view anywhere
• Save clear, accurate still images and motion video to the internal flash memory or removable USB ThumbDrive(TM)

Standards Compliance and Classifications

MIL-STD-810G
United States Department of Defense Environment
Tests Sections 506.5, 507.5, 509.5, 510.5, 511.5, 514.6, 516.6, 521.3

MIL-STD-461F
United States Department of Defense Electromagnetic
Interference RS103 - ABOVE DECK

Standards Compliance
Group 1, Class A: EN61326-1, UL, IEC, EN CSA-C22.2:61010-1, UN/DOT 38.3

IP Rating
Internally tested to IP55
Rotascope rigid borescopes

We offer borescopes in a large variety of designs with rotatable objective lens probe and focussing as well as with an optional zoom eyepiece, enabling extremely high image resolution and brightness using the latest lens technology made by HSW. Its robust design enables reliable and long-term utilisation for industrial applications.

- Models: 4 mm, 5 mm, 5.5 mm, 6 mm, 8 mm and 10 mm
- Effective lengths: from 158 to 1 450 mm
- Viewing directions: 0°, 45°, 70°, 90° and 110°
- Field of view: 35°, 56°, 70°, 90°
- Using the latest lens technology
- Very high resolution
- Large focus depth
- Excellent transmission
- Excellent recognisibility of details
- Extraordinary brightness
- Very high resolution both in the centre and the peripheral zone of the view field
- Makes the smallest fault visible
- Extremely wide range of uses for all types of applications

Swing-Prism borescopes

Borescopes with variable viewing direction, objective lens probe rotatable by 340°, focussing and optional zoom eyepiece for magnification allow inspections with continuous adjustment from 55°, slanted view ahead, to 115°, retrospective view. All settings are made on the eyepiece. Consequently, the instrument enables to carry out several inspection tasks in a flexible and fast way. Moreover, the viewing range is extended owing to the objective lens probe rotatable by 340°.

- Diameters: 6 mm, 8 mm or 10 mm
- Effective lengths: From 250 mm to 690 mm (larger lengths on request)
- Viewing directions: From 55°, slanted view ahead, to 115° retrospective view
- Field of view: 35° and 50°
- Full-metal design, triple-pipe system made of stainless steel
- Device body and eyepiece are made of aluminium alloy with hard anodic coating
- Innovative rotating device allowing a complete separation of the control functions for rotation and swing prism
- Adaptable fibre-optic light guide entry piece (ACM, Wolf). The adapter allows to connect many other makes.
- Uniform illumination of the remote object owing to a separated optical outlet at the tip. Increased light output by use of a light condenser in all devices up to Ø 6 mm.
- The instrument is resistant to fuels, oil and other conventional solvents as well as water-tight
GBMS (Gun Barrel Management System) is a database and analysis software that collects and contains measurement data from the Robinca system or other measurement tools. GBMS compiles management data from measurement data and displays the data for decision making. GBMS provides interface to other military records. This is to support the Armed Forces service organization and weapon experts in their assessment and evaluation of condition and quality of the individual weapon system or the global fleet. Safety and operational availability will improve and maintained in the best possible way by not exceeding tolerances. Wear and damage can be detected before they cause accidents or provide poor performance during a mission.

Every gun barrel measurement tool generates a lot of measurement data. To be able to save measurement data and analyze the information, the Gun Barrel Management System database is vital. In an informative and well-arranged way GBMS makes measurement data from the Robinca system or other measurement tools available. It combines the measurement data with Defence organization data and material to support the service organization of the Armed Forces and weapon experts in their assessment and evaluation of the quality and condition of the individual tubes or of the total fleet.

It also provides functionality to compare inspections over time for the same barrel – including pictures – and compare inspections from different barrels. It stores all the inspections in the database and allows the users to see details develop over time. GBMS organizes the barrels and weapon systems into groups and hierarchies that can be changed and defined by the Administrator user. For each weapon system you can register shots, ammo used, in order for the officers to keep track of the usage of the weapon and the time to next inspection according to the limits recommended by the producer and the authorities. It is also possible to register other useful information like hit rate and temperature influencing the wear and tear for the barrel.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Barrel type</th>
<th>Ea</th>
<th>Status</th>
<th>Reason</th>
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</thead>
<tbody>
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<td>Brigade 1</td>
<td>30mm barrel</td>
<td>149</td>
<td>Approved</td>
<td></td>
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<td>15</td>
<td>Approved w/comment</td>
<td></td>
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<td>30mm barrel</td>
<td>12</td>
<td>Not evaluated</td>
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</tr>
<tr>
<td>Brigade 1</td>
<td>120mm smooth bore</td>
<td>35</td>
<td>Approved</td>
<td></td>
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<td>Brigade 1</td>
<td>120mm smooth bore</td>
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<td>Not evaluated</td>
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<tr>
<td>Brigade 2</td>
<td>155mm barrel</td>
<td>56</td>
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<td>155mm barrel</td>
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<td>Shooting prohibition</td>
<td>Safety</td>
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<td>155mm barrel</td>
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<td>Shooting prohibition</td>
<td>Safety</td>
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<table>
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<tr>
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<tr>
<td>Shooting prohibition</td>
<td>10</td>
<td>2,4</td>
</tr>
</tbody>
</table>
GBMS analysis
Gun Barrel Management System

The database stores all your measurement data and shooting log in one place. It’s easy to import and update.

All material are compared with the prevailing tolerances, and based upon these limits a notice is given if they are exceeded.

GBMS makes collaboration easy and it gives complete control over the future activities like next measurement, ranking (status) and number of shots for the cannon barrels and small arms.

Implement your processes to ensure that everyone follows the same best practices and activities to make sure that nothing is forgotten.

You can easily create reports. You can combine the data in a myriad of ways to get the information that you need.

External reference: Norwegian Defence Logistics Organisation

Configurations

Dacon can offer an adapted solution for every need. Like a minimum configuration based upon a stand alone pc up to a server configuration accessible for users on the network.

The minimum configuration is a stand alone system. There is no communication between other systems. No common database for analytics. The system is suitable for small independent operation. This is not an optimal solution for fleet management.

Server configuration is the ultimate system. It is designed to give a full view of a fleet and supports all bases and competent authority. GBMS is an extremely powerful, yet very user friendly and simple to understand, analysis tool that helps an organization to keep total control.
QtBCS is the user interface of the Robinca system. It connects all the different components and functions and collects all data. QtBCS guides the operator through the inspection step by step.

QtBCS combines, organizes and creates graphical reproductions based on the measurement data. Images with and without measurement data are processed and stored.

From the automatically stored QtBCS file six different report formats can be chosen according to the required level of detail immediately after a measurement sequence.
Small caliber report

BCS result file
Barrel station : 17 / 0    Chamber station : 0 / 0
Pictures : 10    Laser Measures : 0
Max diameter : 7.884    Min diameter : 7.601

Software Revision : QtBCS 1.2.0.26
Operator : Halvard Heimlund
NATO stock number:
Vehicle registration number:
Shots count:

Barrel

Software Revision : QtBCS 1.2.0.26
Operator : Halvard Heimlund
NATO stock number:
Vehicle registration number:
Shots count:

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Operator : Halvard Heimlund
NATO stock number:
Vehicle registration number:
Shots count:

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Shots count:

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Operator : Halvard Heimlund
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Vehicle registration number:
Shots count:

Software Revision : QtBCS 1.2.0.26
Operator : Halvard Heimlund
NATO stock number:
Vehicle registration number:
Shots count:
Medium caliber report

Tolerances

30mm bushmaster
Δ 25: 30.036 + 0.08mm
0 - 75mm: 30.01 + 0.065mm
Grooves: 31.4 ± 0.105mm
120mm smooth barrel report

**Angular Section: Average Diameter (mm)**

- Station (mm) / Angular position (degree)
- 0°, 1°, 2°, 3°, 4°, 5°, 6°, 7°, 8°, 9°, 10°, 11°, 12°, 13°, 14°, 15°, 16°, 17°
- Measurements: 54.5 mm, 48.3 mm, 50.2 mm, 49.8 mm, 48.6 mm, 48.3 mm, 49.2 mm, 49.5 mm, 50.1 mm, 50.3 mm, 49.8 mm, 49.2 mm, 48.6 mm, 48.3 mm, 49.2 mm, 49.5 mm, 50.1 mm

**Angular Section: Min Diameter (mm)**

- Station (mm) / Angular position (degree)
- 0°, 1°, 2°, 3°, 4°, 5°, 6°, 7°, 8°, 9°, 10°, 11°, 12°, 13°, 14°, 15°, 16°, 17°
- Measurements: 54.5 mm, 48.3 mm, 50.2 mm, 49.8 mm, 48.6 mm, 48.3 mm, 49.2 mm, 49.5 mm, 50.1 mm, 50.3 mm, 49.8 mm, 49.2 mm, 48.6 mm, 48.3 mm, 49.2 mm, 49.5 mm, 50.1 mm

**Angular Section: Max Diameter (mm)**

- Station (mm) / Angular position (degree)
- 0°, 1°, 2°, 3°, 4°, 5°, 6°, 7°, 8°, 9°, 10°, 11°, 12°, 13°, 14°, 15°, 16°, 17°
- Measurements: 54.5 mm, 48.3 mm, 50.2 mm, 49.8 mm, 48.6 mm, 48.3 mm, 49.2 mm, 49.5 mm, 50.1 mm, 50.3 mm, 49.8 mm, 49.2 mm, 48.6 mm, 48.3 mm, 49.2 mm, 49.5 mm, 50.1 mm

**BCS result file**

- Barrel station: 6 / 0
- Chamber station: 6 / 0
- Pictures: 29
- Laser Measures: 4
- Max diameter: 170.042
- Min diameter: 119.866

**Barrel**

- Tube
  - Ref: 120mm inv2
  - ID: 205
  - Length: 520mm
  - Tube Diameter: 12.8mm
  - Grove Diameter: 6mm
  - Grove Count: 8

**Probe**

- Ref: laying
  - 130072
  - Laser:

**Stations (6)**

<table>
<thead>
<tr>
<th>Station Number</th>
<th>Station (mm)</th>
<th>Tube: outside view</th>
<th>Grove: outside view</th>
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</table>
SALES OFFICES

Dacon AS
Gamle Ringeriksvei 6
1321 Stabekk
Norway
Phone: +47 21 06 35 11
E-mail: knut.glorvigen@dacon.no
Site: www.dacon.no
Contact: Knut Glorvigen, Sales Manager

Dacon Inspection Technology BV
Jonckerweg 20A
2201 DZ Noordwijk
Netherlands
Phone: +31 62 33 18 630
E-mail: rutger.vanduijn@dacon.no
Site: www.dacon.no
Contact: Rutger van Duijn, Sales Engineer