Robot Inspection and Calibration System
ROBINCA

DACON

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.

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Operational configuration management

Reduced barrel life cycle costs

Increased target precision

Better planning and barrel life estimation

Lifetime evaluation

High resolution

Capacitive sensors

Visual inspection

Conditioning monitoring

Measurement

Automatic report generation

Laser line deflection

Gun Barrel Management

Safety

Cost efficiency

Overview

Resource exploitation

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:

Capacitive sensors	Very high resolution, non-contact, fast, accurate, environmentally resilient
Laser line deflection measurement	Non-contact, no moving part, fast, scanning effect
Camera	Tilt/rotate, internal lights, high resolution and sensitivity
Laser position unit and crawler	Localizes and recovers damages

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

Caliber	Diameter measurement	Area measurement	Pit erosion	Integrated Camera	Position laser	Software QtBCS
155mm	v	v		v	v	v
120mm	v	v	v	v	v	v
120mm chamber	v					v
105mm	v	v		v	v	v
30mm	v					v
12,5mm	v					v
7,62mm	v					v
5,56mm	v					v
4,60mm	v					v
Calibers of other dimensions are quoted on request.						

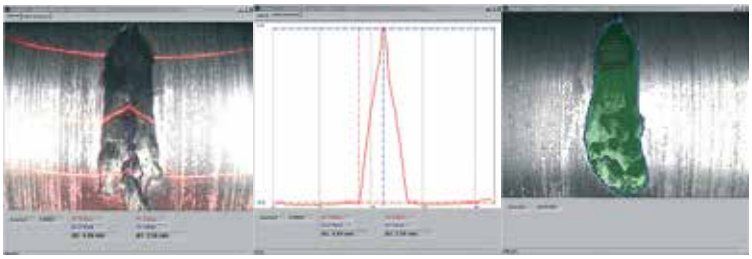
Robinca 120mm measurement probe

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.



Technical specifications

Robinca 120mm measurement head

Length:	380mm
Weight:	9kg
Diameter:	Ø119,6mm
Material:	Anodized aluminium
Colour:	Black

Diameter measurement

Technology:	Capacitive sensors
No. of sensors:	8
Accuracy 119-122mm:	±0,005mm
Accuracy 122-126mm:	±0,020mm
Resolution:	±0,001mm

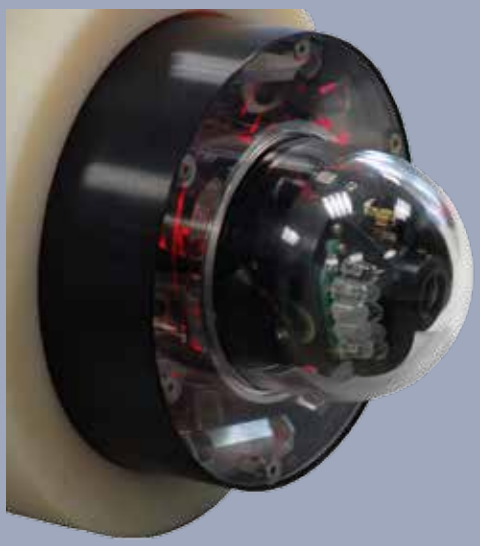
Calibration ring and certificate

Depth measurement

Technology:	Laser line deflection
Accuracy 0-7mm:	±0,050mm
Resolution:	±0,005mm

Camera

Specifications:	See page 9



Description of use

The Robinca measurement probe is inserted into the muzzle end of the barrel by means of an alignment sleeve. Visual inspection is performed utilizing a rotating colour camera equipped with internal lights. The measurement unit is moved into the barrel by an electric crawler, and then positioned at each measuring point.
At measurement positions, the capacitive sensors collect measurement data from the barrel. Average measurement accuracy is better than +/-5 microns. Repeatability is +/-1 micron.
Stored data can be displayed and reports is automatically produced from QtBCS software.

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.

Technical specification

Robinca 120mm chamber measurement probe

Lenght:	737,7mm
Weight:	13kg
Diameter:	Ø158,0mm
Material:	Anodized aluminium
Colour:	Black dim

Diameter measurement

Technology:	Capacitive sensors
No. of sensors:	16
Accuracy 119 (+4/-0)mm:	±0,020mm
Accuracy 158 (+4/-0)mm:	±0,020mm
Resolution:	±0,002mm

Calibration ring and certificate

Description of use

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

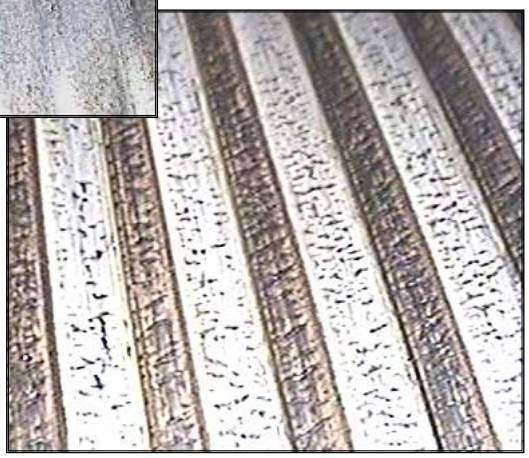
At the predefined measurement positions, the capacitive sensors collect measurement data from the barrel. Average measurement accuracy is better than +/-20 microns. Repeatability is +/-1 micron. Stored data can be displayed and reports is automatically produced from QtBCS software

Robinca 105 &155mm measurement probe

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, potentional 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.

Technical specifications

Robinca 30mm measurement head

$Length_{tot}$:	2 660mm
$Weigth_{tot}$:	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

Description of use

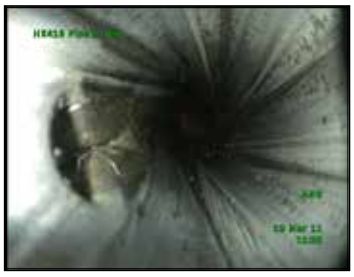
Robinca is inserted into the muzzle end of the barrel by extendable rods resting in a tripod mounted crib. The probe is pushed and rotated in the barrel manually according to instructions from the QtBCS software. At the selected measurement positions, the capacitive sensors collect measurement data from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

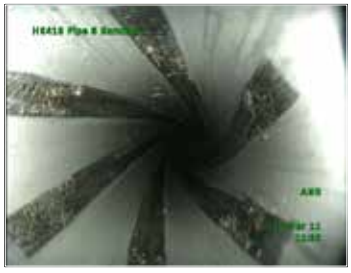
Robinca small caliber

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, potentional 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.

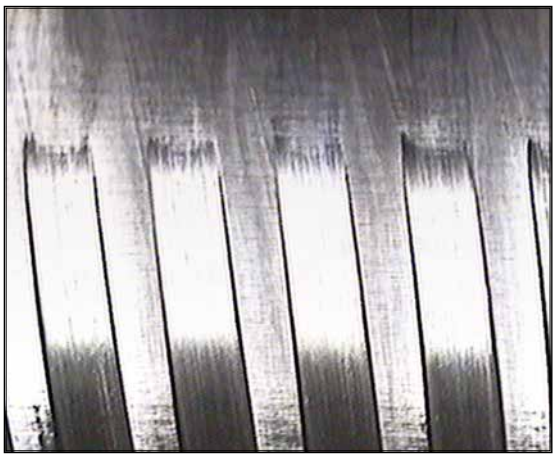




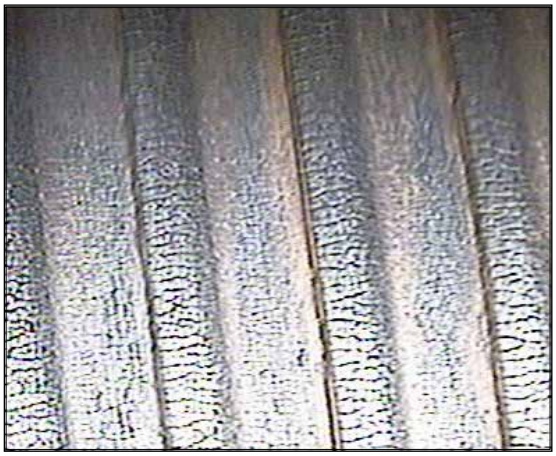
Description of use

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.

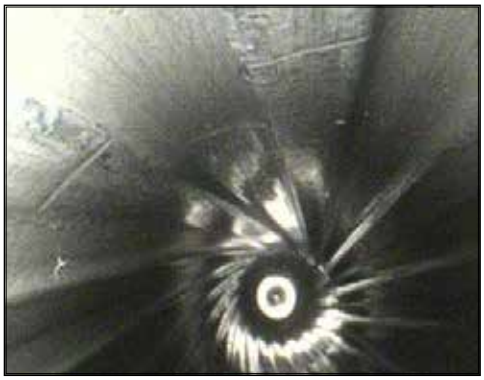
Examples of findings

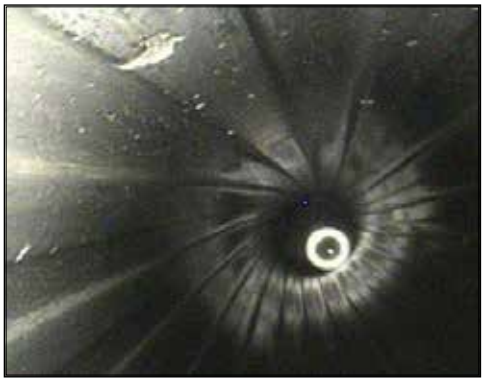


Same 155mm cannon barrel - brand new and towards wear life time



155mm cannon barrel - copper deposits





30mm cannon barrel - detonation inside

Mentor Visual iQ VideoProbe

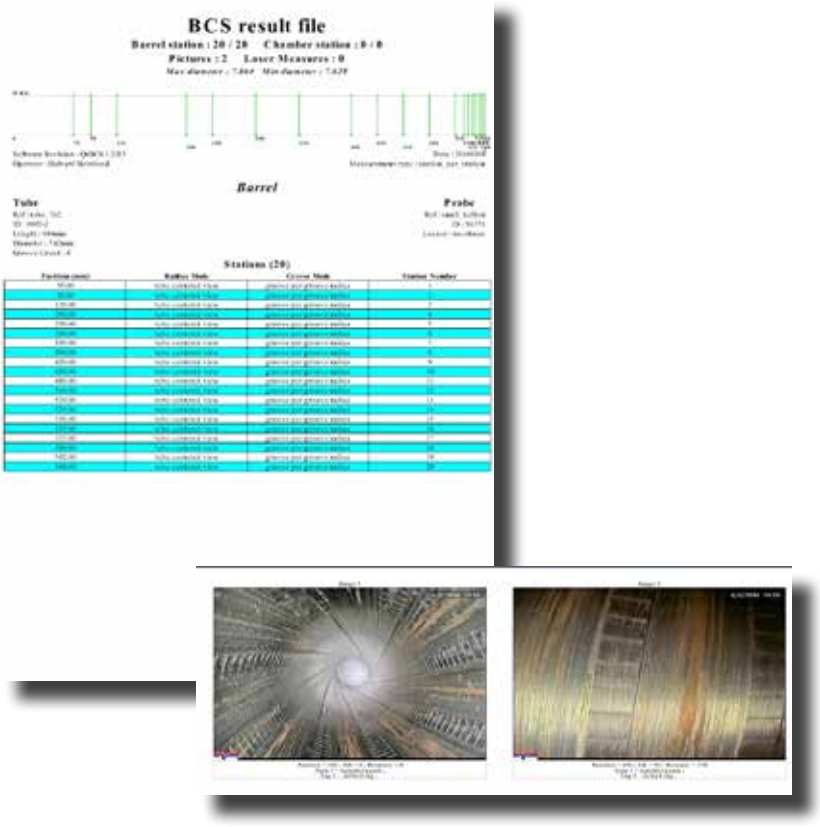
Visual inspections can detect indications that helps an operator to make good decisions in condition monitoring of cannon barrels, engines or turbines.

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:	Yes

- 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

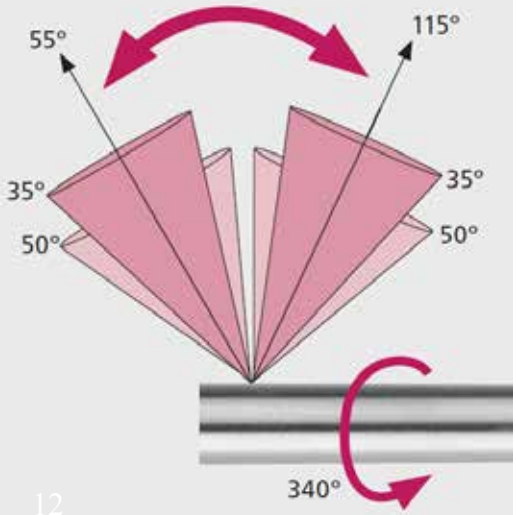
Swing-Prism borescopes

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 is water-tight



GBMS analysis

Gun Barrel Management System

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.

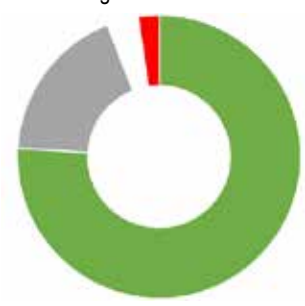
Every gun barrel measurement tool generates a lot of measurement data. To be able to save measurement data and analyze the information, the Gun Barrel Management System database is vital.
In an informative and well-arranged way GBMS makes measurement data from the Robinca system or other measurement 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.

Unit	Barrel type	Ea	Status	Reason
Brigade 1	30mm barrel	149	Approved	
Brigade 1	30mm barrel	15	Approved w/comment	
Brigade 1	30mm barrel	12	Not evaluated	
Brigade 1	120mm smooth bore	35	Approved	
Brigade 1	120mm smooth bore	9	Not evaluated	
Brigade 2	155mm barrel	56	Approved	
Brigade 2	155mm barrel	36	Not evaluated	
Brigade 2	155mm barrel	8	Shooting prohibition	Safety
Brigade 3	155mm barrel	79	Approved	
Brigade 3	155mm barrel	19	Not evaluated	
Brigade 3	155mm barrel	2	Shooting prohibition	Safety

Status	Ea	%
Approved	319	76
Approved w/comment	15	3,5
Not evaluated	76	18
Shooting prohibition	10	2,4

Operational status
Fleet management



ENHANCE SAFETY & OPERATIONAL AVAILABILITY

CONDITION MONITORING

SUPPORT FOR PURCHASE & NEGOTIATIONS

OPTIMIZE HIT PROBABILITY

FOLLOW-UP CONTRACTS, GUARANTEES & PROCEDURES

Interaction with executive systems

Verifying manufacturers data

Ensure the area of knowledge/experience

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.

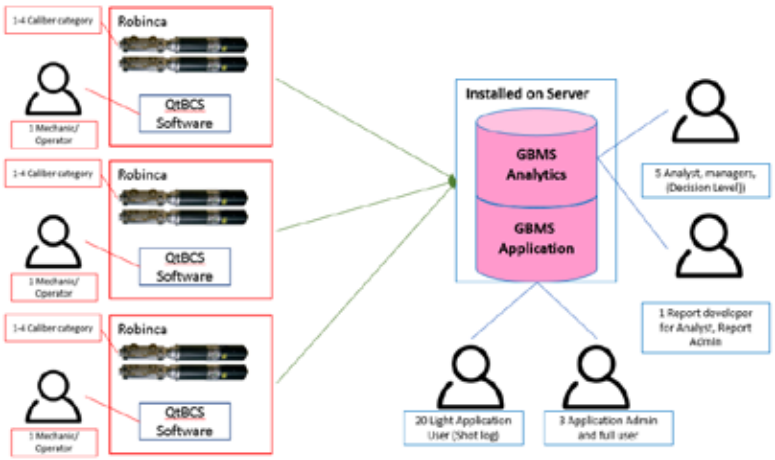
External reference: Norwegian Defence Logistics Organisation

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 databse 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.



Verifying performance as a barrel wears on

Economical saving

Register shooting log

Estimated life calculation

QtBCS Software

Software Directed Inspection (SDI)

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.

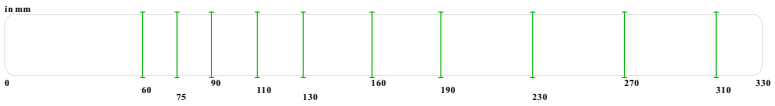
QtBCS combines, organizes and creates graphical reproductions based on the measurement data. Images with and without measurement data are processes and stored.

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:

Date : 20160928
Measurement type : station_per_station

Barrel

Tube
Ref : tube_762
ID : 0033
Length : 330mm
Tube Diameter : 7.62mm
Groove Diameter : 0mm
Groove Count : 4

Probe
Ref : small_kaliber
ID : S1571
Layout : mcuframe

Stations (17)

Position (mm)	Radius Mode	Groove Mode	Station Number
60.00	tube centered view	groove per groove radius	1
75.00	tube centered view	groove per groove radius	2
90.00	tube centered view	groove per groove radius	3
110.00	tube centered view	groove per groove radius	4
130.00	tube centered view	groove per groove radius	5
160.00	tube centered view	groove per groove radius	6
190.00	tube centered view	groove per groove radius	7
230.00	tube centered view	groove per groove radius	8
270.00	tube centered view	groove per groove radius	9
310.00	tube centered view	groove per groove radius	10
350.00	tube centered view	groove per groove radius	11
390.00	tube centered view	groove per groove radius	12
410.00	tube centered view	groove per groove radius	13
413.00	tube centered view	groove per groove radius	14
416.00	tube centered view	groove per groove radius	15
419.00	tube centered view	groove per groove radius	16
422.00	tube centered view	groove per groove radius	17

Kalibers Overview (mm)

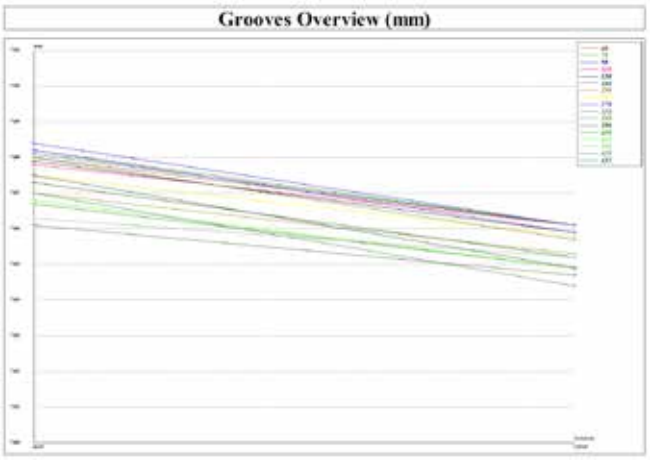
Station (mm) / Angular position (degree)

	0.0°	90.0°
60	7.63	7.62
75	7.64	7.64
90	7.63	7.63
110	7.64	7.63
130	7.64	7.63
160	7.64	7.63
190	7.62	7.61
230	7.64	7.63
270	7.64	7.63
310	7.62	7.60
350	7.65	7.63
390	7.63	7.62
410	7.74	7.71
413	7.75	7.74
416	7.71	7.69
419	7.75	7.73
422	7.80	7.79

Grooves Overview (mm)

Station (mm) / Angular position (degree)

	45.0°	135.0°
60	7.88	7.86
75	7.88	7.86
90	7.88	7.86
110	7.88	7.86
130	7.88	7.86
160	7.88	7.86
190	7.87	7.85
230	7.88	7.86
270	7.88	7.86
310	7.86	7.85
350	7.88	7.86
390	7.87	7.85
410	7.87	7.85
413	7.87	7.85
416	7.86	7.85
419	7.87	7.84
422	7.88	7.85



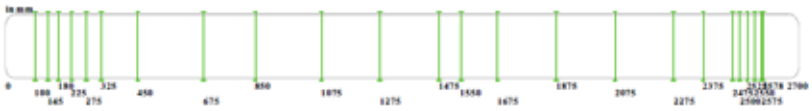
Medium caliber report

BCS result file

Barrel station : 24 / 0 Chamber station : 0 / 0

Pictures : 14 Laser Measures : 0

Max diameter : 31.303 Min diameter : 30.036



Software Revision : QtBCS 1.2.0.12
Operator : Halvard Heimlund
NATO stock number :
Vehicle registration number:
Shots count: ukjent

Date : 20161125
Measurement type : station_per_station

Barrel

Tube
Ref : ref_30
ID : 04330261
Length : 2700mm
Tube Diameter : 30mm
Groove Diameter : 0mm
Groove Count : 16

Probe
Ref : small_kaliber
ID : PRO Z 027#p30A
Layout : mcuframe

Stations (24)

Position (mm)	Radius Mode	Groove Mode	Station Number
100.00	tube centered view	groove per groove radius	1
145.00	tube centered view	groove per groove radius	2
180.00	tube centered view	groove per groove radius	3
225.00	tube centered view	groove per groove radius	4
275.00	tube centered view	groove per groove radius	5
325.00	tube centered view	groove per groove radius	6
450.00	tube centered view	groove per groove radius	7
675.00	tube centered view	groove per groove radius	8
850.00	tube centered view	groove per groove radius	9
1075.00	tube centered view	groove per groove radius	10

Grooves Overview (mm)

Station (mm) / Angular position (degree)

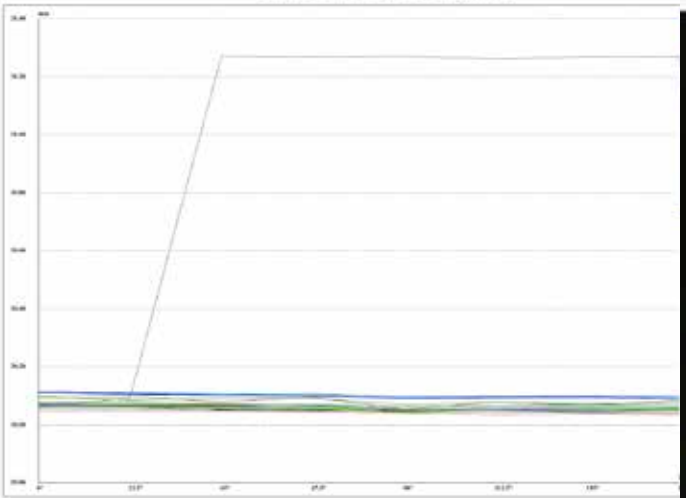
	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
100 mm	31.25	31.25	31.26	31.25	31.19	31.18	31.20	31.18
145 mm	31.23	31.24	31.23	31.25	31.18	31.19	31.17	31.19
180 mm	31.22							
225 mm	31.22							
275 mm	31.24							
325 mm	31.23							
450 mm	31.25							
675 mm	31.27							
850 mm	31.28							
1075 mm	31.27							
1275 mm	31.27							
1475 mm	31.27							
1550 mm	31.26							
1675 mm	31.26							
1875 mm	31.27							
2075 mm	31.27							
2275 mm	31.27							
2375 mm	31.28							
2475 mm	31.30							
2500 mm	31.30							
2525 mm	31.27							
2550 mm	31.30							
2575 mm	31.28							
2578 mm	31.27							

Kalibers Overview (mm)

Station (mm) / Angular position (degree)

	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
100 mm	30.09	30.10	30.08	30.09	30.05	30.08	30.07	30.08
145 mm	30.10	30.09	30.09	30.09	30.07	30.08	30.07	30.07
180 mm	30.07	30.07	30.06	30.07	30.05	30.05	30.05	30.05
225 mm	30.05	30.05	30.05	30.05	30.04	30.04	30.04	30.04
275 mm	30.06	30.06	30.05	30.05	30.05	30.05	30.04	30.04
325 mm	30.06	30.05	30.05	30.05	30.05	30.05	30.05	30.05
450 mm	30.07	30.07	30.07	30.07	30.06	30.07	30.07	30.07
675 mm	30.06	30.07	30.06	30.06	30.05	30.05	30.05	30.05
850 mm	30.07	30.07	30.07	30.06	30.05	30.05	30.05	30.06
1075 mm	30.06	30.07	30.07	30.06	30.05	30.05	30.05	30.05
1275 mm	30.07	30.07	30.06	30.06	30.05	30.05	30.05	30.06
1475 mm	30.06	30.06	30.06	30.05	30.05	30.05	30.05	30.05
1550 mm	30.06	30.07	30.06	30.06	30.05	30.05	30.05	30.06
1675 mm	30.06	30.06	30.06	30.06	30.04	30.05	30.05	30.06
1875 mm	30.06	30.07	30.07	30.06	30.05	30.05	30.05	30.05
2075 mm	30.07	30.09	31.27	31.27	31.27	31.26	31.27	31.27
2275 mm	30.07	30.07	30.07	30.07	30.05	30.06	30.06	30.06
2375 mm	30.08	30.08	30.07	30.07	30.06	30.07	30.07	30.07
2475 mm	30.11	30.11	30.11	30.11	30.10	30.10	30.10	30.10
2500 mm	30.11	30.11	30.10	30.11	30.10	30.10	30.10	30.10
2525 mm	30.11	30.10	30.10	30.10	30.09	30.09	30.10	30.10
2550 mm	30.11	30.11	30.11	30.10	30.09	30.09	30.09	30.09
2575 mm	30.11	30.11	30.10	30.10	30.09	30.09	30.09	30.09
2578 mm	30.12	30.11	30.10	30.10	30.09	30.10	30.10	30.09

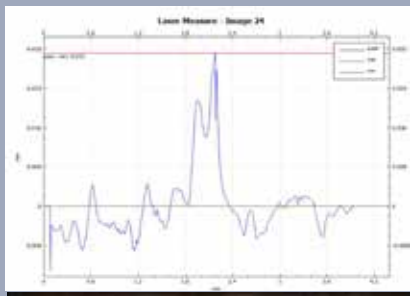
Kalibers Overview (mm)



Tolerances

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

120mm smooth barrel report



BCS result file

Barrel station : 6 / 0 **Chamber station : 6 / 0**

Pictures : 29 **Laser Measures : 4**

Max diameter : 120.042 Min diameter : 119.866

Software Revision : QtBCS 1.2.0.12
Operator : Halvard Heimlund
NATO stock number : 1015-12-178-9535
Vehicle registration number: Nammo Testrør
Shots count: 292

Date : 20161205
Measurement type : station_per_station

Barrel

Tube
Ref : 120mm leo2
ID : 2265
Length : 5280mm
Tube Diameter : 120mm
Groove Diameter : 0mm
Groove Count : 0

Probe
Ref : analog
ID : PRO Z0276120A
Layout : cascaded

Stations (6)

Position (mm)	Radius Mode	Groove Mode	Station Number
70.00	tube centered view	groove to groove diameter	1
205.20	tube centered view	groove to groove diameter	2
400.00	tube centered view	groove to groove diameter	3
3300.70	tube centered view	groove to groove diameter	4
3999.60	tube centered view	groove to groove diameter	5
4690.30	tube centered view	groove to groove diameter	6

Angular Section : Average Diameter (mm)

Station (mm) / Angular position (degree)

	0°	6°	12°	18°	24°	30°	36°	42°	48°	54°	60°	66°	72°	78°	84°	90°	96°	102°	108°	114°	120°	126°	132°	138°	144°	150°	156°	162°	168°	174°
70 mm	119.99	119.99	120.00	120.00	120.00	119.99	120.00	120.00	120.00	119.99	119.98	119.99	119.99	119.98	119.98	119.98	119.97	119.96	119.98	119.97	119.95	119.96	119.97	119.96	119.96	119.97	119.98	119.98	119.99	119.99

Angular Section : Min Diameter (mm)

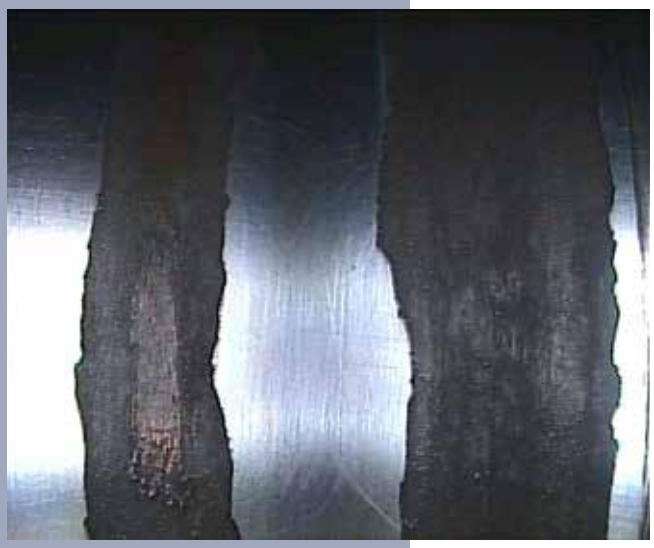
Station (mm) / Angular position (degree)

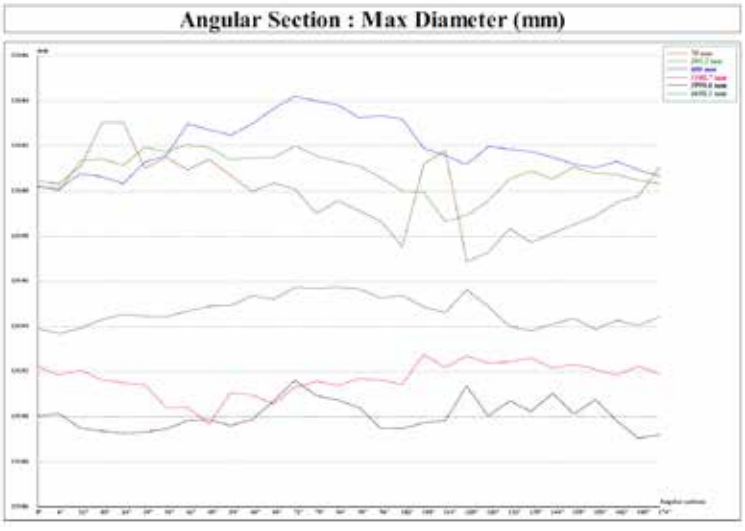
	0°	6°	12°	18°	24°	30°	36°	42°	48°	54°	60°	66°	72°	78°	84°	90°	96°	102°	108°	114°	120°	126°	132°	138°	144°	150°	156°	162°	168°	174°
70 mm	119.97	119.97	119.99	119.98	119.97	119.98	119.98	119.98	119.99	119.97	119.97	119.97	119.97	119.97	119.97	119.96	119.96	119.93	119.95	119.94	119.94	119.95	119.95	119.95	119.95	119.95	119.96	119.97	119.98	119.98

Angular Section : Max Diameter (mm)

Station (mm) / Angular position (degree)

	0°	6°	12°	18°	24°	30°	36°	42°	48°	54°	60°	66°	72°	78°	84°	90°	96°	102°	108°	114°	120°	126°	132°	138°	144°	150°	156°	162°	168°	174°
70 mm	120.00	120.00	120.01	120.03	120.03	120.01	120.02	120.01	120.01	120.01	120.00	120.00	120.00	119.99	120.00	119.99	119.99	119.98	120.01	120.02	119.97	119.97	119.98	119.98	119.98	119.99	119.99	119.99	120.00	120.01
205.2 mm	120.00	120.00	120.01	120.01	120.01	120.02	120.02	120.02	120.02	120.01	120.01	120.01	120.02	120.02	120.01	120.03	120.01	120.00	120.00	119.99	119.99	120.00	120.01	120.01	120.01	120.01	120.01	120.01	120.00	120.00
400 mm	120.00	120.00	120.01	120.01	120.00	120.01	120.02	120.03	120.03	120.02	120.03	120.04	120.04	120.04	120.04	120.03	120.03	120.03	120.02	120.02	120.01	120.02	120.02	120.02	120.02	120.01	120.01	120.01	120.01	120.01
3300.7 mm	119.92	119.92	119.92	119.92	119.92	119.91	119.90	119.90	119.90	119.91	119.91	119.91	119.91	119.92	119.91	119.92	119.92	119.91	119.93	119.92	119.93	119.92	119.92	119.93	119.92	119.92	119.92	119.92	119.92	119.92
3999.6 mm	119.90	119.90	119.89	119.89	119.89	119.89	119.89	119.90	119.90	119.90	119.90	119.91	119.92	119.91	119.91	119.90	119.89	119.89	119.90	119.90	119.91	119.90	119.91	119.90	119.91	119.90	119.91	119.90	119.89	119.89
4690.3 mm	119.94	119.94	119.94	119.94	119.95	119.94	119.94	119.95	119.95	119.95	119.95	119.95	119.96	119.96	119.96	119.96	119.95	119.95	119.95	119.95	119.96	119.95	119.94	119.94	119.94	119.94	119.94	119.94	119.94	119.94





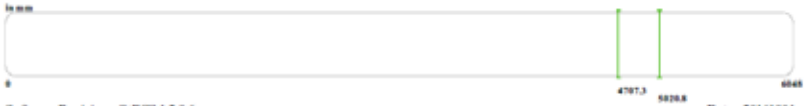
155mm caliber report

BCS result file

Barrel station : 2 / 2 Chamber station : 0 / 0

Pictures : 7 Laser Measures : 0

Max diameter : 157.604 Min diameter : 155.044



Software Revision : QtBCS 1.2.0.6
Operator : Halvard Heimlund

Date : 20161004
Measurement type : station_per_station

Barrel

Tube
Ref : 155mm
ID : 2063
Length : 6048mm
Diameter : 155mm
Groove Count : 48

Probe
Ref : analog
ID : PRO A 0266155A
Layout : cascaded

Stations (2)

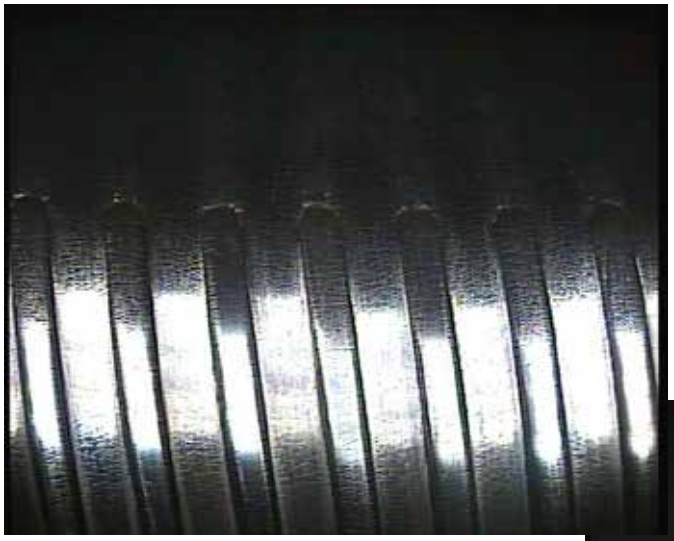
Position (mm)	Radius Mode	Groove Mode	Station Number
4707.30	tube centered view	groove to groove diameter	1
5020.80	tube centered view	groove to groove diameter	2

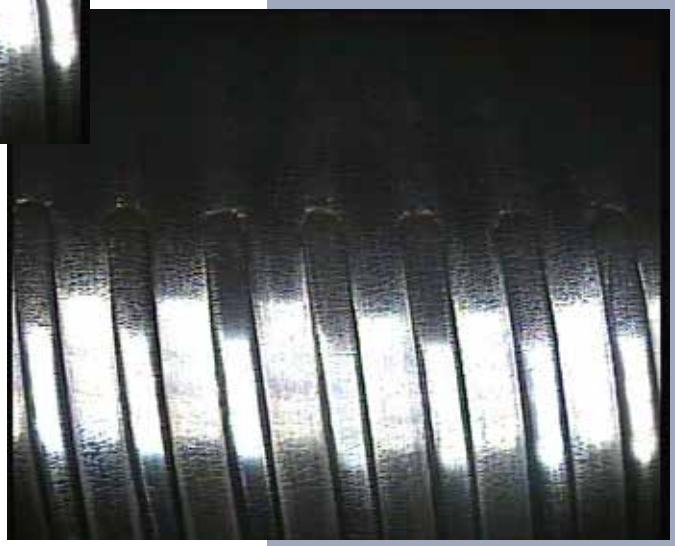
Grooves Overview (in mm)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	157.455	157.495	157.491	157.488	157.487	157.476	157.483	157.484	157.473	157.474	157.474	157.472	157.442	157.418	157.422	157.425	157.413	157.412	157.424	157.417	157.402	157.437	157.430	157.411
	157.563	157.604	157.598	157.595	157.591	157.587	157.582	157.581	157.576	157.572	157.564	157.563	157.545	157.523	157.527	157.532	157.526	157.532	157.538	157.537	157.537	157.536	157.530	157.542

Kalibers Overview (in mm)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	154.946	154.933	154.935	154.918	154.923	154.918	154.925	154.921	154.899	154.906	154.904	154.903	154.907	154.927	154.932	154.941	154.944	154.946	154.948	154.958	154.963	154.962	154.958	154.955
	155.080	155.077	155.069	155.064	155.068	155.059	155.051	155.049	155.058	155.055	155.044	155.048	155.062	155.075	155.074	155.093	155.091	155.110	155.133	155.094	155.092	155.100	155.093	155.095





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