

Protective Coatings Inspection Kit



Introduction

This handbook describes the characteristic, features and calibration methods of selected instruments used in the coating inspection process. The instruments that have been selected for this inspection kit are considered one of the best in quality and the prices are also affordable.

With this inspection kit, the end user will be able to cover a majority of the coating inspection process in corrosion control. It allows the user to detect the ambient conditions/ paint temperature, measure the surface profile of a blast surface, measure the wet film of fresh paint and dry film thickness and detect the surface profile. In addition, the Fitz's Atlas of coating defects contains more than 100 color images of 64 coating defects and provides a clear and concise description, highlights possible causes, advises on prevention and suggests appropriate repair procedures.

This is a starter kit to determine the environmental conditions, surface profile and dry film thickness measurement of protective coatings over steel or ferrous substrates.



Basic Inspection Kit

- QNix 4200 –Dry film Thickness gauge
- RH% dew Point Meter
- Testex tape Roll (X-Coarse)
- Testex sanp gauge
- Surface Thermometer
- Fitz Atlas
- Sets of 5 certified shims
- Reference Zero plates
- Illuminated inspection mirror X7
- Economy carrying case (16.3"*9.25"*3.5")

Replace Dry Film Thickness Gauge to suit your needs, as follows:

- QNix Keyless Basic model: For wireless and safe measurements for climbers
- QNix Keyless Memory model : For wireless and safe measurements for climbers, memorizing and evaluating readings on PC.
- QNix 8500 basic model with Fe 80 mil probe and cable
- QNix 8500 premium model with Fe 80 mil probe incl. accessories for memorizing and evaluating readings on PC.

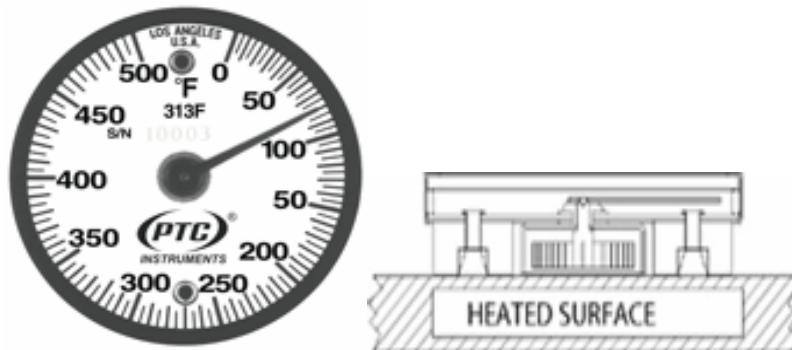
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To prevent failures of coating systems quality it is important to control the application or ambient condition, control wet – and dry film thickness and then, control the finished coating for adhesion, gloss, hardness, etc....

1.) Paint Surface Temperature

When taking information about ambient conditions, it is advisable to take them at the actual locations of work. Take and monitor ambient condition before and periodically throughout the work day. The surface temperature should be at minimum 5 degrees higher than the dew point temperature for any applications.



PTC[®]'s Dual Magnet Mount Surface Thermometers are specifically designed to measure surface temperatures. Made in the USA of quality materials, these thermometers can be used on any horizontal surface or held on any magnetic surface. These instruments feature two high temperature alnico magnets that act as the thermometers base and hold the instrument in place. The bimetallic sensor is located in a draft shield and is in virtual thermal contact with the surface to be measured. This gives the instrument a relatively quick response time. The thermometer reaches sensing equilibrium (stability) within three minutes. Single or max-min ancillary hands are available for this instrument as an option.

Designed for applications such as: hot plates; griddles; die-cast dies; foundry core boxes; annealing ovens; weld preheats; motors, generators, and engines; bearings; boilers, tanks ect.

PTC Metrology is accredited by A2LA to ISO/IEC 17025, ANSI/NCSL Z540-1-01 for NIST traceable certifications. Our calibration lab has several choices for surface thermometer calibrations from basic NIST traceable certification to customer selected logged critical temperature points which include as received and as returned data; a statement of uncertainty; laboratory conditions and information on the primary standards. For complete temperature certification services please click on the link.

2.) Traceable® Pocket Hygro./Dew Point/Therm.



(Certification complies with ISO/IEC 17025 and ANSI/NCSL Z540-1)

When surface temperature is below dew point there is the formation of rust, weak adhesion, weak inter-coat adhesion, surface defects and chemical reactions. Therefore determining both surface temperature and dew point are very important. In other words, surface temperature must be above the dew point.

Specifications: Relative humidity range is 0 to 100.0% RH with a resolution of 0.1% · RH accuracy of $\pm 3\%$ RH mid-range to $\pm 4\%$ RH elsewhere · Dew point and temperature ranges are -20.0 to 50.0°C and -4.0 to 122°F with a resolution of 0.1° and an accuracy of $\pm 1^{\circ}\text{C}$ · Size is $6\text{-}1/2 \times 2 \times 2/3$ inches · Weight is 3 ounces

Compact design features an electronic capacitance polymer film sensor not affected by condensation, may be used in 100% humidity

Relative humidity range is 0 to 100.0% RH with a resolution of 0.1% and an accuracy of $\pm 3\%$ RH mid-range to $\pm 4\%$ RH elsewhere. Both dew point and temperature ranges are -20.0 to 50.0°C and -4.0 to 122°F with a resolution of 0.1° and an accuracy of $\pm 1^{\circ}\text{C}$. Full range response is 30 to 60 seconds.

To assure accuracy an individually serial-numbered Traceable® Certificate is provided from our ISO 17025 calibration laboratory accredited by A2LA. It indicates traceability to standards provided by NIST (National Institute of Standards and Technology). At the press of a button, unit recalls minimum/maximum readings. Hold button freezes the display to record a reading. Dual display shows relative humidity with either dew point or temperature on a $3/4$ -inch-high LCD display. Rugged ABS plastic case is $6\text{-}1/2 \times 2 \times 2/3$ inches; weight is 3 ounces. It is supplied with a Traceable® Certificate and two AAA batteries.

Operation

1. Remove the protective cover.
2. Press the ON/OFF button to turn the meter on.
3. Press and hold the C/F button until the display changes to the desired range.
4. Press and hold "td" button until "td" appears on the display to show the current dew point.
5. Cancel dew point reading by pressing again on "td".

2.) SURFACE PREPARATION (ISO 12944)

GAR Surface Profile Comparators - Shot & Grit –blasted surfaces.

To use the comparators the eyes must be trained to compare the depth of profile. Help yourself with an illuminated magnifier

Magnifiers provide an in-focus and highly defined view of surface details, illuminating uniformly over the field of observation.

High-powered magnification has universal application for precise scientific, plant, and fieldwork. Illuminated magnifiers are supplied with AA replaceable batteries. Replacement battery Cat. No. 1111. Replacement bulb Cat. No. 8707.

SH-6 MICROFINISH COMPARATOR Surface Roughness Scale

It provides an economical tool which permits roughness to be specified on the same basis as linear measurements. The surfaces presented are the result of years of research and engineering. Details covering this subject are now published in The American National Standards Institute (ANSI) specification titled: "SURFACE TEXTURE, SURFACE ROUGHNESS, WAVINESS AND LAY." ANSI/ASME B46.1

The SH-6 MICROFINISH COMPARATOR Surface Roughness Scale is made by a dual electroforming process wherein nickel is electrodeposited to provide an exact reproduction in intricate detail. The same electroforming process used to produce the Surface Roughness Scale is available from GAR Electroforming to serve your product needs.

The surfaces used in this scale are reproductions of accurately shot-blasted surfaces measured in microinches (millionths of an inch - 0.000001"). The numbers engraved alongside each surface are the average deviation from the mean surface expressed in microinches.

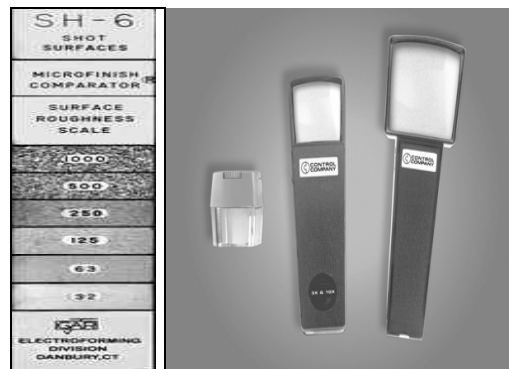
The SH-6 MICROFINISH COMPARATOR Surface Roughness Scale provides industry with established flat surface roughness specimens for visual and tactual comparison.

The SH-6 Shot-Blast MICROFINISH COMPARATOR is rectangular in shape (1"x 5") and is a corrosion resistant electroformed nickel duplicate of actual shot-blasted surfaces. There are six replicated shot-blasted surface finish specimens ranging from 32 to 1000 microinches.

The SH-6 Microfinish COMPARATOR is supplied in a leatherette case with engineering data and instructions. The SH-6 is also available in metric with micrometer designations.

Use

- 1.) Place the MICROFINISH COMPARATOR Surface Roughness Scale alongside your work piece.
- 2.) Slide the scale so that the rectangle with the surface roughness you want is adjacent to the piece you are examining.
- 3.) Place the magnifier 10X in contact with both disc and substrate. Compare each section of the comparator with the substrate. Note that roughness might fall between two sections.
- 4.) Also compare by drawing the tip of the fingernail across each surface at right angles to the tool mark.
- 5.) The feel of the fingernail contact must be the same if the finishes are identical.



The G-6 MICROFINISH COMPARATOR Surface Roughness Scale

It provides an economical tool which permits roughness to be specified on the same basis as linear measurements. The surfaces presented are the result of years of research and engineering. Details covering this subject are now published in The American National Standards Institute (ANSI) specification titled: "SURFACE TEXTURE, SURFACE ROUGHNESS, WAVINESS AND LAY". ANSI/ASME B46.1

The G-6 MICROFINISH COMPARATOR Surface Roughness Scale is made by a dual electroforming process wherein nickel is electrodeposited to provide an exact reproduction in intricate detail. The same electroforming process used to produce the Surface Roughness Scale is available from GAR Electroforming to serve your product needs.

The surfaces used in this scale are reproductions of accurately grit-blasted surfaces measured in microinches (millionths of an inch 0.000001"). The numbers engraved alongside each surface are the average deviation from the mean surface expressed in microinches.

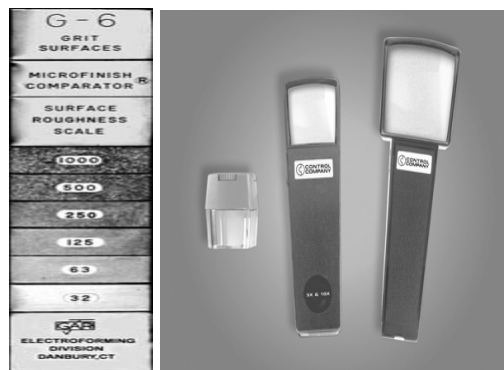
The G-6 MICROFINISH COMPARATOR Surface Roughness Scale provides industry with established flat surface roughness specimens for visual and tactual comparison. It is used in specifying and controlling surface roughness when a product having the appearance of typically grit-blasted surfaces is required.

The G-6 Grit-Blast MICROFINISH COMPARATOR is rectangular in shape (1" x 5") and is a corrosion resistant electroformed nickel duplicate of actual grit-blasted surfaces.

There are six replicated grit-blasted surface finish specimens ranging from 32 to 1000 micrometers.

The G-6 MICROFINISH COMPARATOR is supplied in a leatherette case with engineering data and instructions.

The G-6 is also available in metric with micrometer designations.



Use

- 1.) Place the MICROFINISH COMPARATOR Surface Roughness Scale alongside your work piece.
- 2.) Slide the scale so that the rectangle with the surface roughness you want is adjacent to the piece you are examining.
- 3.) Place the magnifier 10X in contact with both disc and substrate. Compare each section of the comparator with the substrate. Note that roughness might fall between two sections.
- 4.) Compare by drawing the tip of the fingernail across each surface at right angles to the tool mark.
- 5.) The feel of the fingernail contact must be the same if the finishes are identical.

TERMINOLOGY

TYPE:

The specimens are electroformed replicas of original shot or grit-blasted surfaces.

MATERIAL:

This MICROFINISH COMPARATOR Surface Roughness Scale is made of nickel. It will not corrode.

APPEARANCE:

Each specimen has the surface roughness characteristics of a grit-based metallic material.

SURFACE

Means the finely spaced surface irregularities produced by the cutting action of the grit-blast media.

ROUGHNESS:

UNIFORMITY

AND

ACCURACY:

The original masters and the electroformed replica production masters have been checked at evenly distributed intervals. Sufficient measurements were taken to determine a representative average. The rating listed is the average of these readings.

LAY:

This is the term used to designate the direction of predominant surface irregularities.

FLAWS:

These are the irregularities which may appear at infrequent intervals. They are not typical of a grit-blast surface.

3.) SURFACE PROFILE –TESTEX PRESS-O-FILM REPLICA TAPE



Testex Tape (Press-O-Film) offers a simple and very accurate method of measuring blasted profiles. can produce virtually exact replicas of the blasted surface profile which can be measured using a Snap Gauge, see picture above. Simple operation, place the Testex firmly on the blasted surface, apply moderate pressure with the Burnishing Tool, the replica has now been taken and can be measured using the Snap Gauge. Testex Tape is supplied in a roll containing 50 tests and is available in four different grades to cater for different applications. The Snap Gauge is supplied in a Carrying Case with a Burnishing Tool. This complies with ASTM, NACE and SSPC methods of measurement. Can be also supplied in a Testex Kit, comprising two rolls of Testex Tape, (X Coarse supplied as standard, specify different grade if required) Snap Gauge and Burnishing Tool.

The Textex kit includes two rolls of X-Coarse grade Testex Tape, Testex Snap Gauge, Burnishing Tool. Grades of Testex Tape can also be supplied in this kit on request. Accessories and Calibration Certificate.

Use

- Make sure the surface is clean before testing.
- Depending on the anticipated profile depth to be measured you can choose between the Coarse (0.8-2.0 mil) and X-Coarse (1.5 – 4.5 mils) tapes. Profiles below 0.8 mil will not be appropriate for testing.
- Remove the wax paper backing on the tape and place the tape on the blast cleaned surface with the emulsion side down.
- Vigorously rub mylar with burnishing tool until it turns uniformly gray.
- Remove the tape and place replica between the anvils of the snap gauge.
- Close anvils and read, then substrate 2.0 mils from it –which is the thickness of non compressed mylar.

4) DRY FILM THICKNESS GAUGE

The user has the option of choosing between different coating thickness gauges, depending on the application as follows:

- For spot checking on paint –QNix 4200 (4a)
- For spot checking for application with climbing – QNix Keyless Basic (4b)
- For spot checking for application with climbing – QNix Keyless Memory with Software & Interface Cable(4bb)
- For spot checking with Zero averaging (BMR) - QNix 8500 Premium (4c)
- For spot checking with Zero averaging (BMR) with Software & USB wireless Interface– QNix 8500 Premium (4cc)

4a.) FERROUS PROBE DRY FILM THICKNESS GAUGE – QNix 4200



Description

The QNix 4200 sets a Coating Thickness Measurement. The gauge is compact and robust - designed by Engineers for the Engineer. It offers unparalleled flexibility. The QNix 4200 allows you to accurately measure coating thickness on iron and steel substrates. Display - Clear graphic display with high resolution,

Use

- The instrument is factory calibrated.
- For more accurate measurements, the probe can still be calibrated on uncoated substrate by placing the correct sensor head on that uncoated substrate and then press the top button on the keypad and release –factory calibration number appears.
- Lift the gauge at least 5” from the uncoated substrate. The gauge switches to zero on the display.
- Now place the sensor head perpendicular to the coated substrate being measured.
- A beep signals reading is taken. This reading is held on the display until another reading is taken.

Technical data

Substrate	Steel or Iron
Minimum object size	Fe 0.4''*0.4 (10*10mm ²)
Minimum Curvature	Convex: 0.02'' (5mm), Concave: 1'' (30mm)
Minimum substrate Thickness	Fe: 8 mil (0.2mm)
Measuring Range	0.00-120 mil
Resolution	0.01 mil up to 9.99 mil, 0.1 mil from 10-40mil, resp. 1 micron.
Accuracy	±(0.08 mil +3%), resp. ±(2 micron+3%)
Temperature Range	Storage: 14°F to 140 °F Operating: 32 °F to 140 °F
Probe	Integrated one point
Power supply	2 AA Alkaline batteries
Dimensions	3.9''*2.4''*1.1''
Weight	3.5 oz., including batteries
Complies to:	To national and international standards and regulations (DIN, ISO,BS,ASTM): DIN 50981, 50984 ISO 2178,2360,2808 BS 5411 (3,11), 3900 (C,5) ASTM B499, D1400, D1186

Verifying the accuracy of the gauge

Plastic certified Shims.

- Zero gauge on the uncoated substrate.
- Place a shim of known thickness on a clean uncoated substrate.
- Take readings.
- Readings should correspond with the thickness of the shim.
- If not, gauge should be sent to supplier or manufacturer for recertification.

Verifying the accuracy of the gauge

Plastic certified Shims.

- Zero gauge on the uncoated substrate.
- Place a shim of known thickness on a clean uncoated substrate.
- Take readings.
- Readings should correspond with the thickness of the shim.
- If not, gauge should be sent to supplier or manufacturer for recertification.



**4b.) WIRELESS DUAL PROBE DRY FILM THICKNESS GAUGE – QNix KEYLESS
(Both Hall Sensor and Eddy current measuring methods)**

QNix keyless is ideal for fast and safe measurements, especially for applications that require climbing.



Description

The only fully automatic coating thickness gauge with radio control probe

No keys - No buttons - No cables - No connectors

- Fe and NFe
- Automatic zeroing
- No calibration
- Mobile miniaturized radio control probe
- One-hand operation for all applications
- Automatic on/off
- Proven Hall sensor technology
- Measuring over all metals

Use

- Remove the probe by turning it 45 degree inside out and then pull out.
- The instrument is automatically calibrated by the inbuilt reference zero plates.
- For more accurate measurements, the probe can still be calibrated on uncoated substrate by placing the correct sensor head on that substrate and then tip the other sensor head. A factory calibration number appears then release and lift probe. The gauge is calibrated to zero on that substrate.
- Now place the sensor head perpendicular to the coated substrate being measured.
- A beep signals reading is taken. This reading is held on the display until another reading is taken.
- A battery sign on the display means power is weak and batteries must be replaced.
- Replace batteries and leave the body gauge with inserted probe to recharge the accumulator before use (approx. 24 hours).

Technical data:

Substrate	Steel or Iron/NFE
Minimum object size	Fe 0.4''*0.4 (10*10mm ²)/NFE0.4''*0.4 (10*10mm ²
Minimum Curvature	Convex: 0.02'' (5mm), Concave: 1'' (30mm)
Minimum substrate Thickness	Fe: 8 mil (0.2mm)
Measuring Range	FE 0.00-200 mil , NFE 0-80 mil
Resolution	0.01 mil up to 9.99 mil, 0.1 mil from 10-40mil, resp. 1 micron.
Accuracy	±(0.08 mil +3%). resp. ±(2 micron+3%)
Temperature Range	Storage: 14°F to 140 °F Operating: 32 °F to 140 °F
Probe	Wireless radio probe
ISM Frequency Band	916 MHz
Metric System	Imperial
Transmission range	Max. 30 meters
Power supply	2 AA Alkaline batteries
Dimensions	3.9''*2.4''*1.1''
Weight	3.5 oz., including batteries
Complies to:	To national and international standards and regulations (DIN, ISO,BS,ASTM): DIN 2808, 50981, 50984 ISO 2178,2360,2808 BS 5411 (3,11), 3900 (C,5) ASTM B499, D1400, D1186

4c.) FERROUS PROBE DRY FILM THICKNESS GAUGE – QNix 8500

Substrate

Steel or Iron & NFE

(Both Hall Sensor and Eddy current measuring methods)

With the QNix 8500 Premium, you can perform Zero Averaging on rough base metal caused by blast cleaning prior paint thickness measurement



Description

The QNix 8500 sets a new standard in Coating Thickness Measurement. The gauge is compact and robust - designed by Engineers for the Engineer. It offers unparalleled flexibility and multiple calibration options. Available as basic or premium model with interchangeable probes

The QNix 8500 allows you to accurately measure coating thickness on iron and steel substrates as well as non-magnetic metal substrates, such as aluminum, zinc, copper, brass, and stainless steel. The gauge features a modular system with interchangeable parts. You will benefit from 2.4 GHz wireless communication with your PC (range up to 30 feet), multiple calibration options, and a configurable language setting.

Display -Clear graphic display with high resolution, Backlit display, Flip option by 180 degrees.

Use

- The instrument is factory calibrated.
- For more accurate measurements, the probe can still be calibrated on uncoated substrate by placing the correct sensor head on that uncoated substrate and then press the top button on the keypad and release –factory calibration number appears.
- Lift the gauge at least 5” from the uncoated substrate. The gauge switches to zero on the display.
- Now place the sensor head perpendicular to the coated substrate being measured.
- A beep signals reading is taken. This reading is held on the display until another.

Minimum object size	Fe 0.4”*0.4 (10*10mm ²)/NFE0.4”*0.4 (10*10mm ²
Minimum Curvature	Convex: 0.02” (5mm), Concave: 1” (30mm)
Minimum substrate Thickness	Fe: 8 mil (0.2mm)
Measuring Range	FE up to 0.00-200 mil , NFE 0-80 mil, Dual probes
Resolution	0.01 mil up to 9.99 mil, 0.1 mil from 10-40mil, resp. 1 micron.
Accuracy	±(0.08 mil +3%). resp. ±(2 micron+3%)
Temperature Range	Storage: 14°F to 140 °F Operating: 32 °F to 140 °F
Probe	interchangeable & wireless probes
Metric System	Imperial
Power supply	2 AA Alkaline batteries
Dimensions	60mm*26mm*22mm
Weight	3.5 oz., including batteries
Complies to:	To national and international standards and regulations (DIN, ISO,BS,ASTM): DIN 2808, 50981, 50984 ISO 2178,2360,2808 BS 3900 (C,5) ASTM B499, D1400, D1186

Technical data

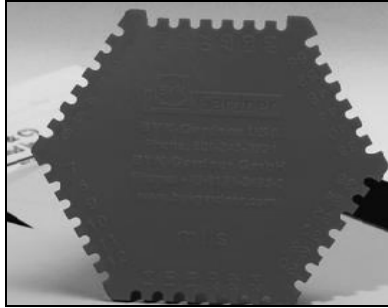
Verifying the accuracy of the gauge

Plastic certified Shims.

- Zero gauge on the uncoated substrate.
- Place a shim of known thickness on a clean uncoated substrate.
- Take readings.
- Readings should correspond with the thickness of the shim.
- If not, gauge should be sent to supplier or manufacturer for recertification.

5.) WET FILM THICKNESS GAUGE

In some cases, coating thickness has to be tested during the process of application. Measuring the film thickness of freshly applied coatings is important for quality reasons as well as cost. The wet film gauge is comb -shaped with six sides, having tabs of varying lengths and made of plastic that can be use up 60 °C (140 °F) .



Use:

- Measure immediately after coating application.
- Use the measuring side of the comb that corresponds to the expected coating thickness.
- Place the comb gage perpendicularly and firmly into the film onto the surface.
- Remove the gauge from the coating.
- The wet film thickness lies between the highest wet tooth and the next dry tooth.
- Do not use Wet film gauge on uneven surfaces.

Note that wet film thickness testing is just to guide the applicator to control what amount of paint to apply and the desired dry film thickness as calculated with this formulas:

$$\text{Dry Film thickness (mil)} = \frac{\text{Wet Film thickness (mil)} * \text{volume solids in \%}}{100}$$

$$\text{Wet Film Thickness (mil)} = \frac{\text{Dry Film Thickness (mil)} * 100}{\text{Volume solids (\%)}}$$

6) FITZ'S ATLAS OF COATING DEFECTS

Fitz's Atlas of Coating Defects is a handy, pocket sized manual which illustrates a range of coating defects. It provides the user with a greater understanding of the defect and gives advice on probable causes, prevention and repair. With the aid of Fitz's Atlas the user can gain an insight into the coatings industry and the pitfalls to watch out for. The manual is ideal for on-site assessment surveys as well as defect analysis for future re-coating, specification review work and writing reports.



Fitz's Atlas has been compiled by coating and corrosion specialists who understand coatings and their application. It provides a comprehensive and invaluable reference for anybody who uses or encounters paint coatings, their defects and failures. Fitz's Atlas of Coating Defects contains more than 100 color images of 64 coating defects and provides a clear and concise description, highlights possible causes, advises on prevention and suggests appropriate repair procedures.

Additional Features

In addition, *Fitz's Atlas* contains sections on the following:

- **Welding Faults:** Welding faults and pre-surface conditions which may be encountered, and need to be addressed prior to the application of any coating system.
- **Surface Preparation:** Two Sections deal specifically with surface preparation, giving guidance notes and standard quality images for both dry abrasive blast cleaning and high pressure water jetting.
- **Marine Fouling:** Following the main pictorial reference of coating defects, a section deals specifically with marine fouling.
- **Appendix:** An appendix provides useful formulae, coating breakdown scales and a reference guide to certain types of coating and coating compatibility.