

KARL DEUTSCH

Automatisierte US-Prüfung von Schweißnähten
Automated Ultrasonic Weld Inspection



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Prüf- und Messgerätebau

ZfP seit 1949 ! *NDT since 1949 !*

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Magnetic Particle Testing



MT Agents and Penetrants



Ultraschonic Testing Systems

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More Than 50 Years In NDT

Coating Thickness Gauges

Crack Depth Gauges

UT Flaw Detectors and Probes

Wall Thickness Gauges

Zerstörungsfreie Material-Prüfung:

- Ultraschall
- Magnetpulver
- Eindring-Prüfung
- Wand- & Schichtdicke
- Risstiefen-Messung



Nondestructive Material Testing:

- *Ultrasonics*
- *Magnetic Particles*
- *Penetrant Testing*
- *Wall & Coating Thickness*
- *Crack Depth Measurement*

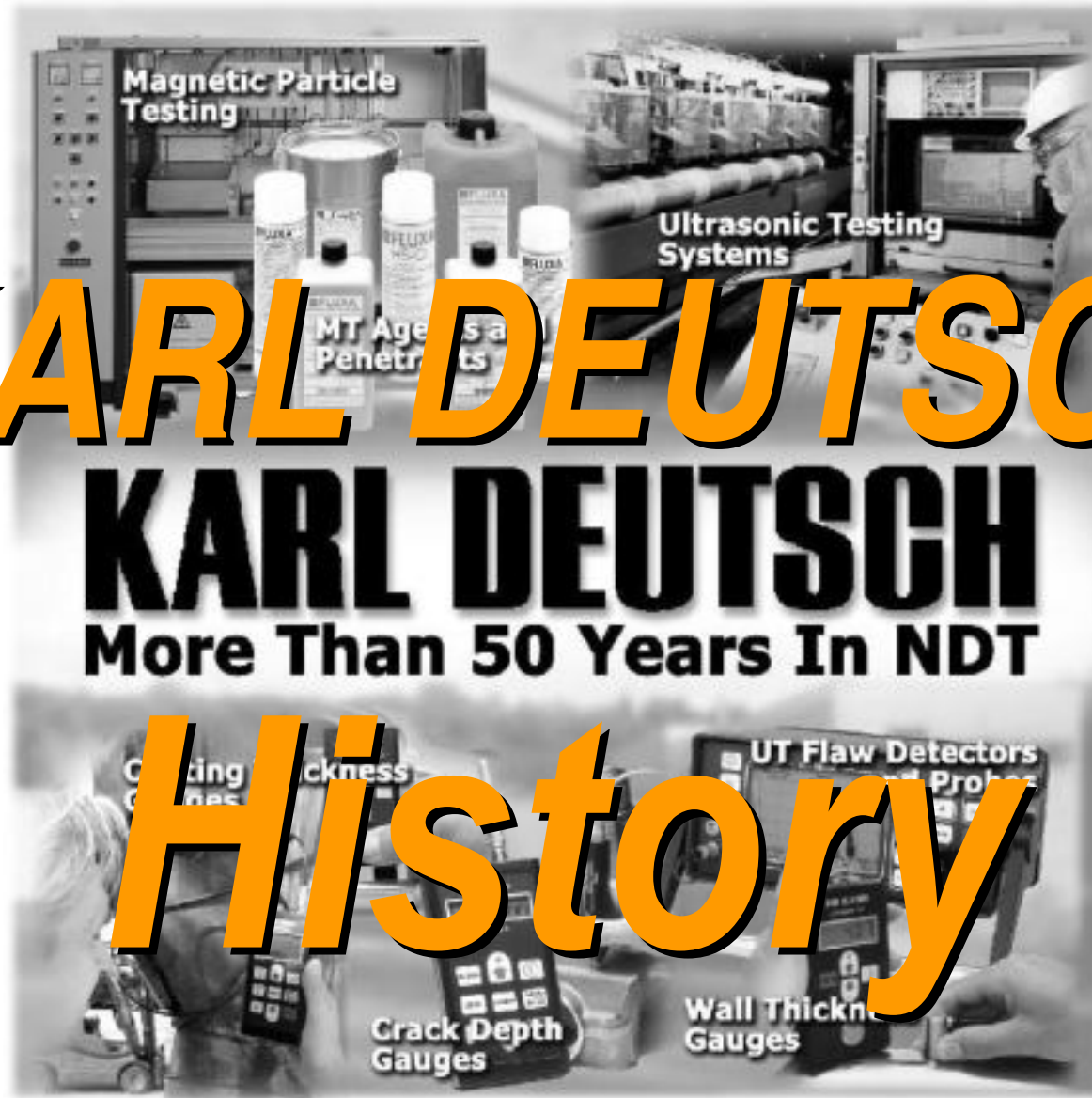
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More Than 50 Years In NDT

History



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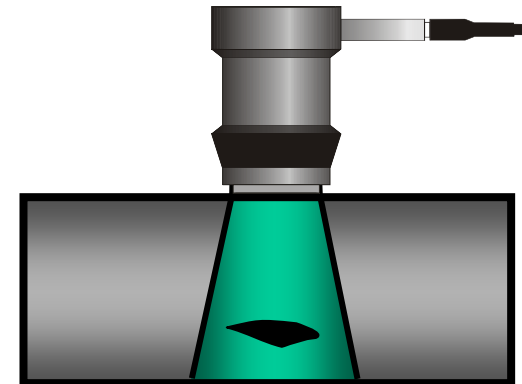


LEPTOSKOP
Schichtdicken-
Messung
seit 1948

LEPTOSKOP
coating thickness
measurement
since 1948

Karl Deutsch & Leptoskop (Hannover Messe 1951)

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5 Jahrzehnte Ultraschall-Prüfung
5 Decades of Ultrasonic Testing

Karl Deutsch ECHOGRAF

KARL DEUTSCH



ECHOGRAPH UMG30: Knüppelprüfung @ Gussstahlwerk Witten (ca 1960)

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DIN EN ISO 9001:2000
Erstmals zertifiziert in 1993 !

DIN EN ISO 9001:2000
First certification in 1993 !

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120 Mitarbeiter in Wuppertal
140 Mitarbeiter weltweit

120 employees in Wuppertal
140 employees worldwide



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Ing. Karl Deutsch
1900 - 1975



Prof. Dr. Volker Deutsch
* 1932, @ KD 1961-2001



Dr._(USA) Wolfram A. Karl Deutsch
@ KD 1998 - ...

3 „Deutsch“-Generationen *3 „Deutsch“ Generations*

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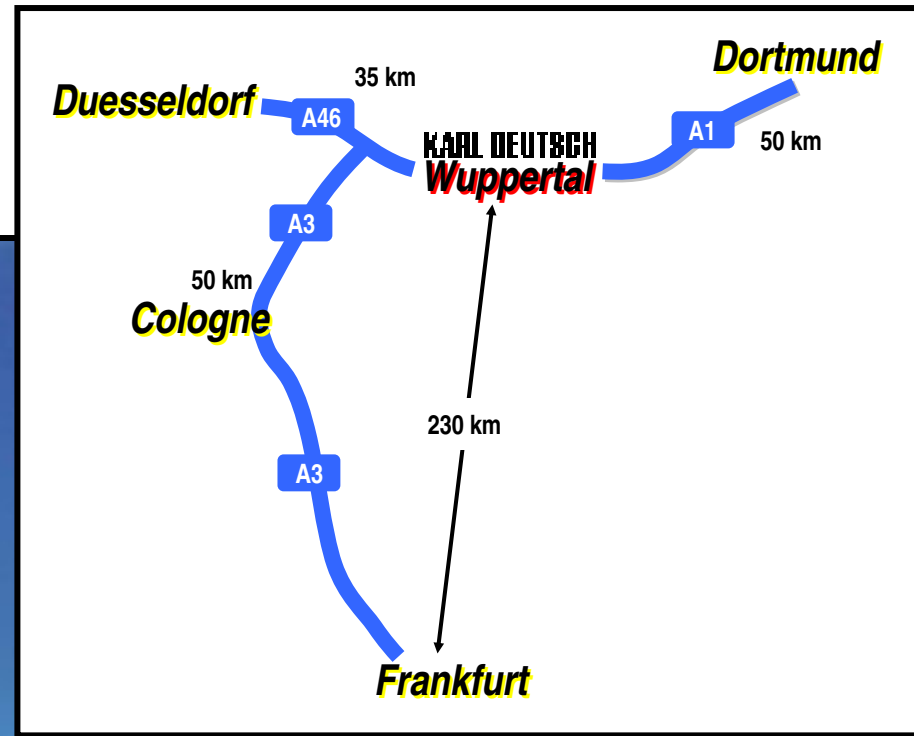
Standort

Location

WUPPERTAL



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WUPPERTAL: Hauptstadt des Bergischen Landes *Capital of the „Bergische Land“*

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Wuppertaler Schwebebahn - natürlich gut geprüft !
Wuppertal's Skytrain - always well tested !

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Werk 1 + 2 in Wuppertal *Works 1 + 2 in Wuppertal*

workshop extension
in 2004



existing workshop
from 1978



Expandierender Anlagenbau im Werk 2 *Expanding Systems Activities in Works2*



Weitere Expansion in 2006... *Further Expansion in 2006...*

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Hallenbau 2006 *Systems Workshop Extension 2006*

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Schulungen nach EN 473

Ultraschall

Magnetpulver

Eindringprüfung



Certificates acc. EN 473

Ultrasonics

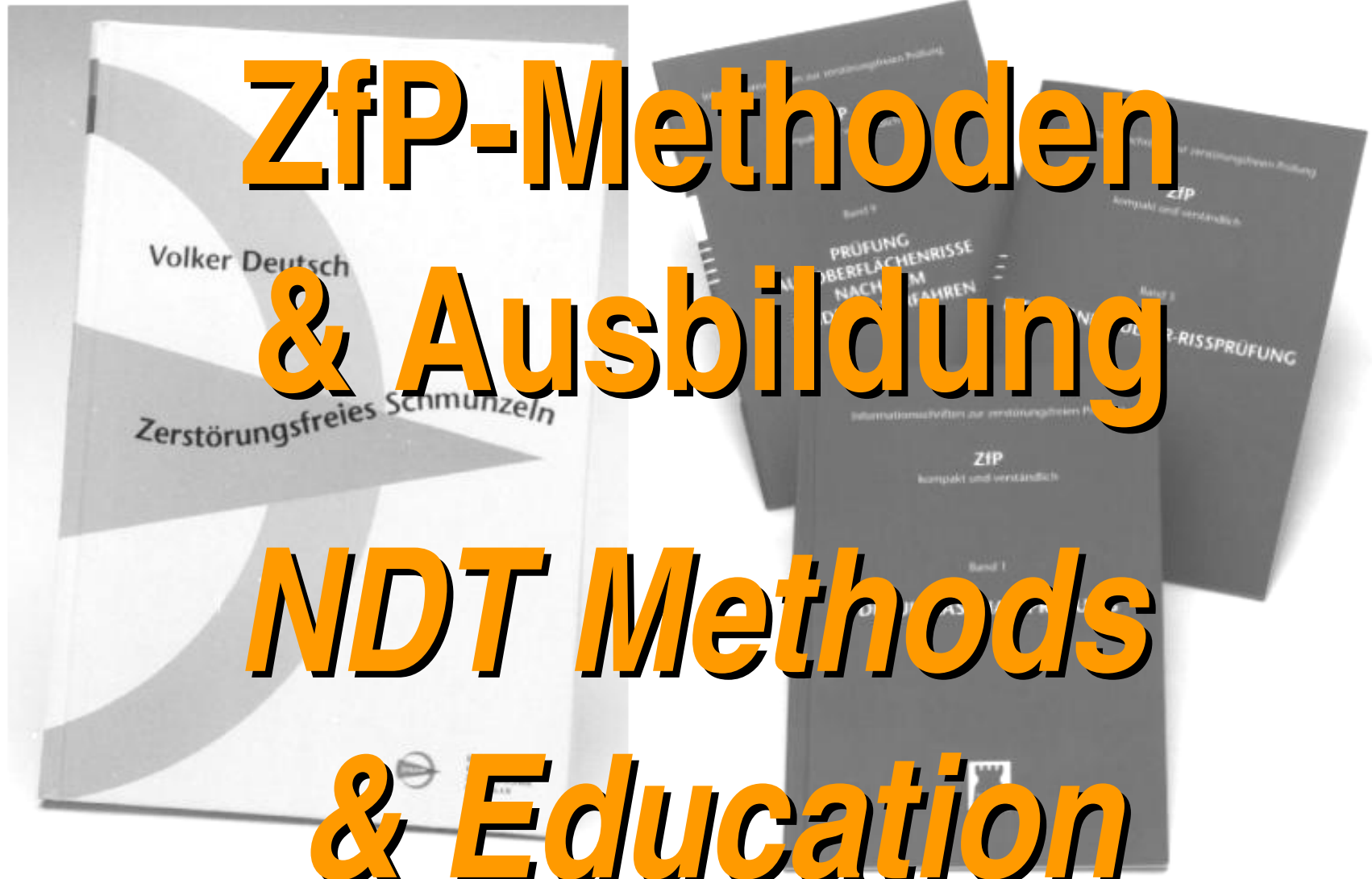
Magnetic Particles

Penetrants



ZfP-Schulungen *NDT Education*

**ZfP-Methoden
& Ausbildung**
***NDT Methods
& Education***



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Prof. Dr.-Ing. Volker Deutsch: ZfP-Bücher **NDT Books**

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Prof. Dr.-Ing. Volker Deutsch et. al.

Band 0: Die ZfP-Verfahren im Vergleich

Band 1: Ultraschall-Prüfung

Band 2: Messtechnik mit Ultraschall

Band 3: Magnetpulver-Rissprüfung

Band 4: Risstiefen-Messung

Band 5: Akustische Resonanzanalyse

Band 6: Schallemissionsprüfung

Band 7: Röntgen-Prüfung

Band 8: Wirbelstrom-Prüfung

Band 9: Eindring-Prüfung

Band 10: Geschichte der
ZfP-Gerätetechnik

Band 11: Spektrometrie

Band 12: Schichtdicken-Messung

Einige Bände auch in weiteren
Sprachen verfügbar
(Spanisch, Chinesisch etc.)



Prof. Dr.-Ing. Volker Deutsch et. al.

Volume 0: Overview on NDT-Methods

Vol 1: Ultrasonic Testing

Vol 2: Measurements with Ultrasound

Vol 3: Magnetic Particle Testing

Vol 4: Crack Depth Gauging

Vol 5: Acoustic Resonance Analysis

Vol 6: Acoustic Emission

Vol 7: X-Ray Inspection

Vol 8: Eddy Current Testing

Vol 9: Penetrant Testing

Vol 10: History of

NDT Instrumentation


Vol 11: Spectral Analysis

Vol 12: Coating Thickness

*Some volumes also available
in further languages
(Spanish, Chinese etc.)*

ZfP Kompakt & Verständlich *NDT Compact & Understandable (Status Sept06)*

Basiswissen
Ultraschallprüfung

 **KARL DEUTSCH**

SCHWEIß **ECHOGRAFIE** **FERNKOPIE** **FERNLABOR**

Basiswissen Ultraschall *Basics on Ultrasonic Testing*

Portable Test Equipment

ECHOGRAPH Ultrasonic Probes

ECHOGRAPH ... Testing S...

DEUTROFLUX Magnetic Particle Testing

FLUXA & -CHECK ...

Produkte

Products



Tragbare Prüfgeräte *Portable Testing Instruments*



ECHOGRAPH 1090: Digitales Ultraschall-Prüfgerät *Digital Ultrasonic Flaw Detector*

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- **neu**
- **präzise**
- **schnell**
- **Grafik-Display**
- **einfach bedienbar**
- **Klartext-Menü**
- **robust**

- **new**
- **precise**
- **fast**
- **graphics display**
- **simple operation**
- **clear-text menu**
- **robust**



Echometer 1075: Wanddicken-Messung *Wall Thickness Measurement*

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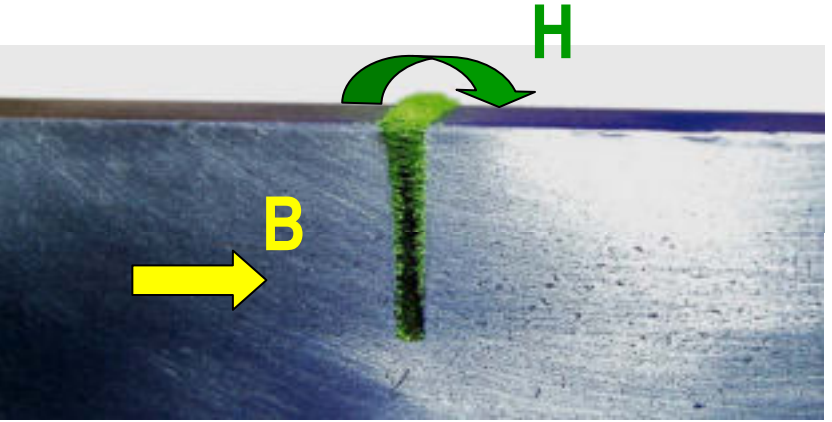
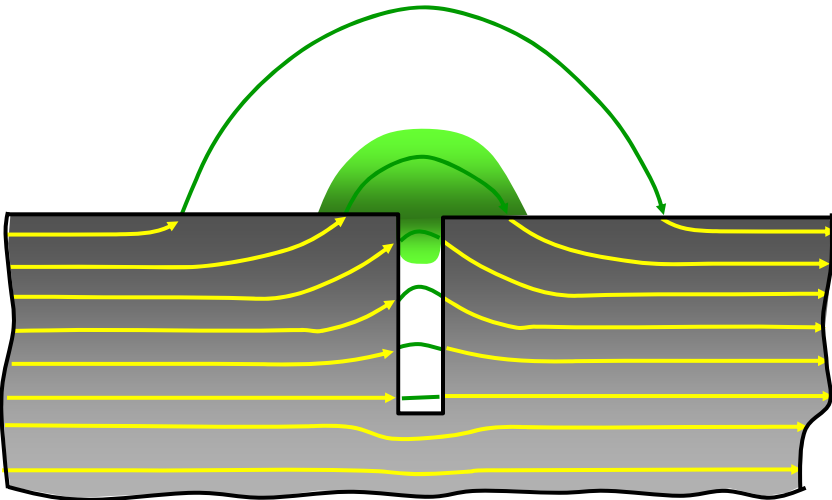
DEUTROFLUX Magnetpulver-Prüfung *Magnetic Particle Testing*

KARL DEUTSCH

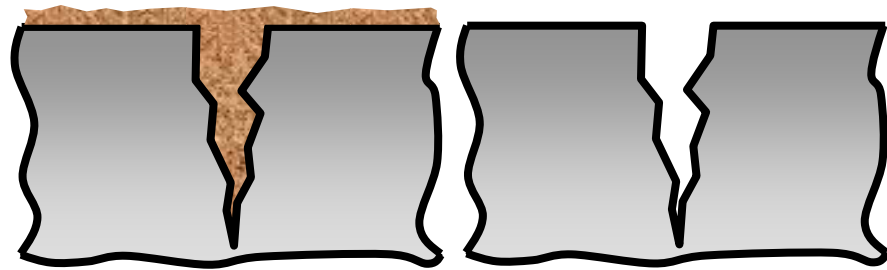


DEUTROPULS & FLUXA: Rohrenden-Test *Pipe End Testing*

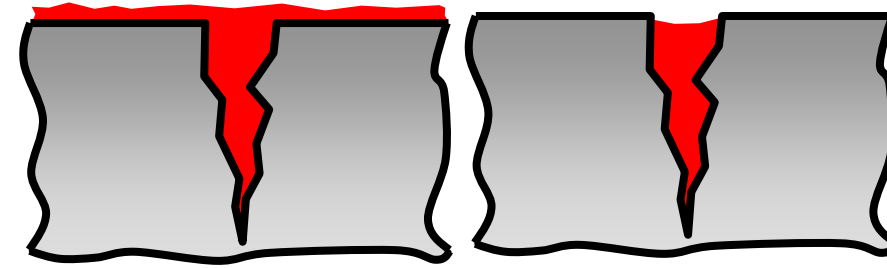
(SNUL-SNUS Overview for PC Feb02, p. 28)



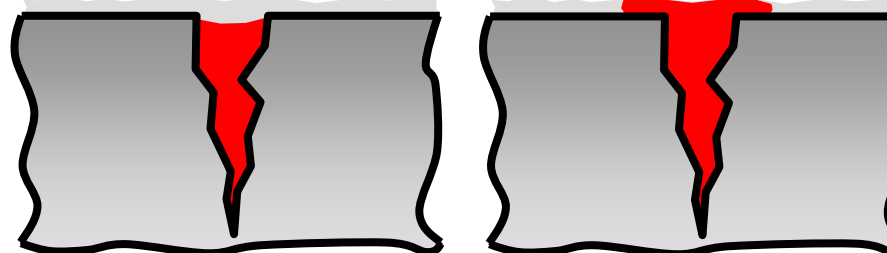
FLUXA: MT-Prüfmittel *MT Inspection Agents*



1. verschmutzter Riss 2. Vorreinigung



3. Auftrag Prüfmittel 4. Zwischenreinigung



5. Entwicklerauftrag 6. Rissanzeige

**DIN EN
ISO 9001**

KD-Check: PT-Prüfmittel *PT Inspection Agents*

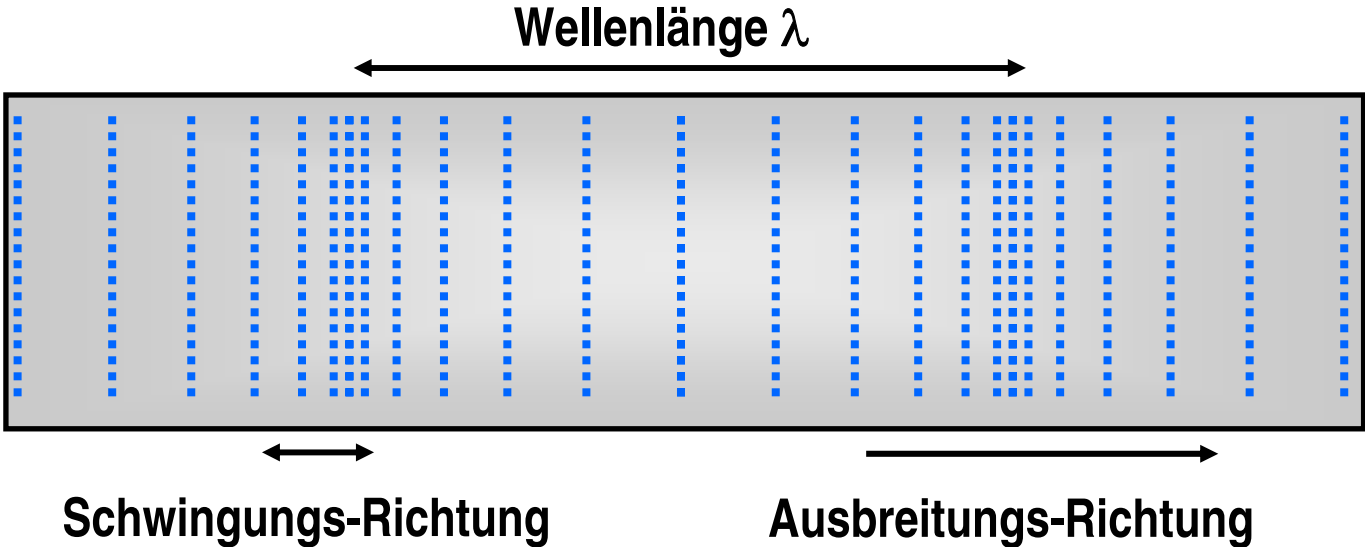


RMG Risstiefen-Messung

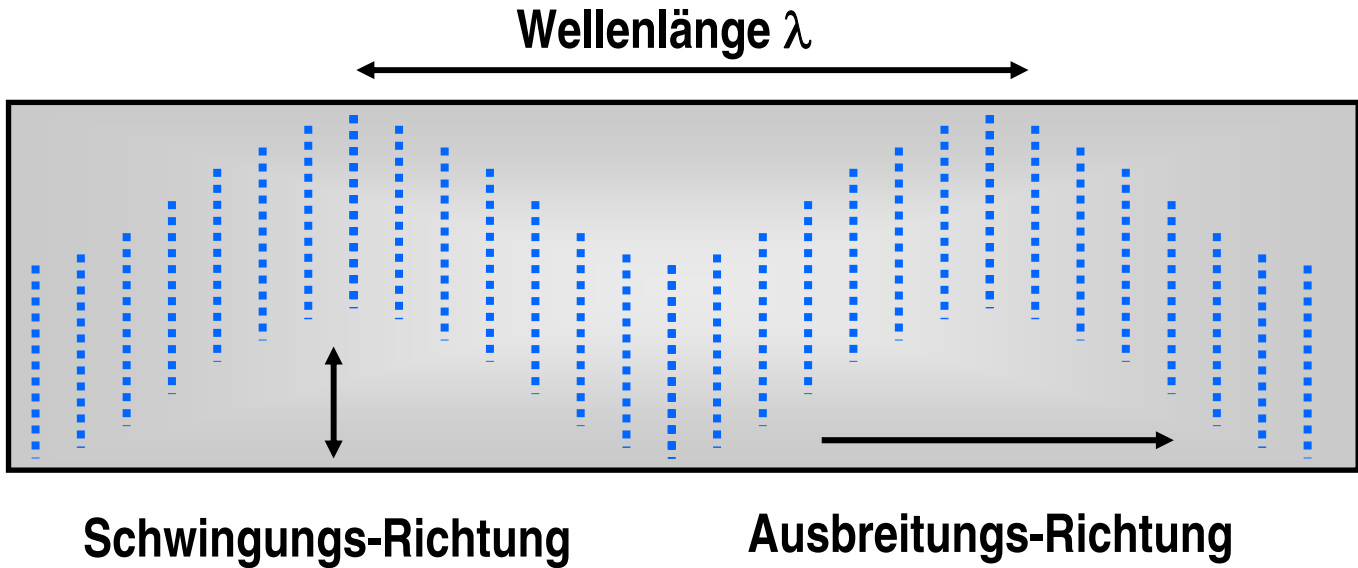
KARL DEUTSCH

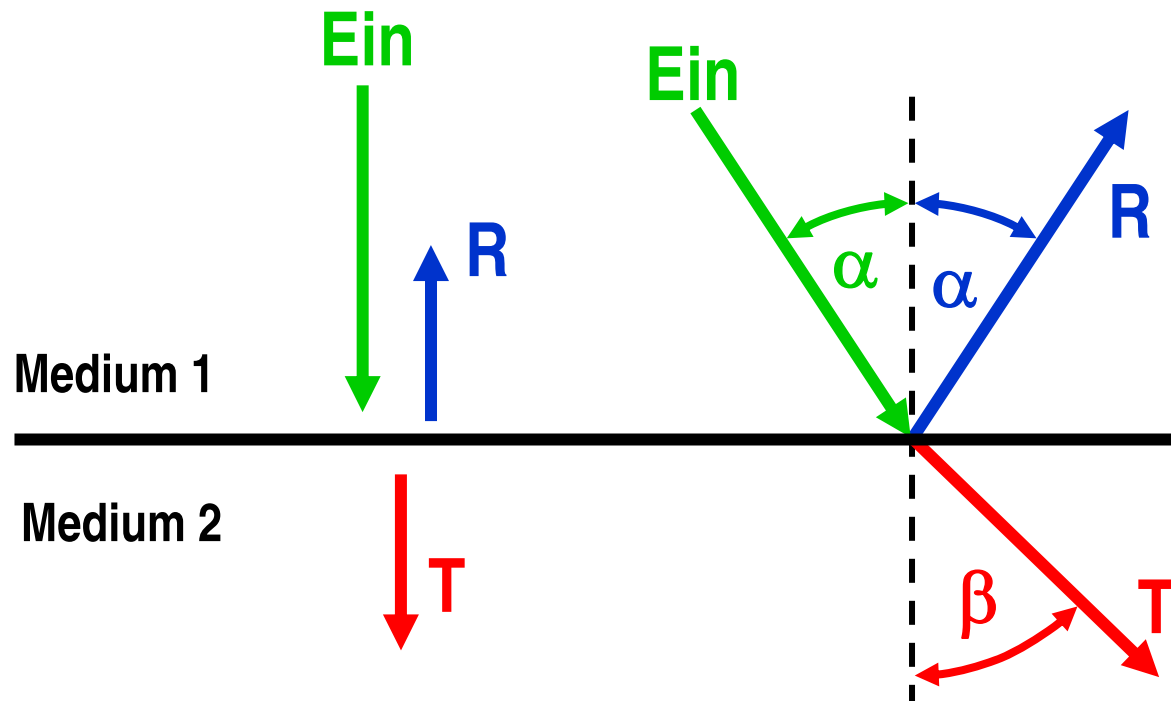


**Longitudinal-
Welle
(c_L)**



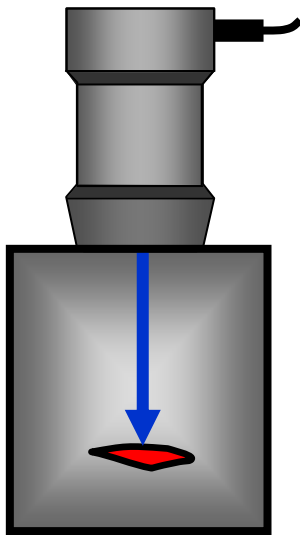
**Transversal-
Welle
(c_T)**



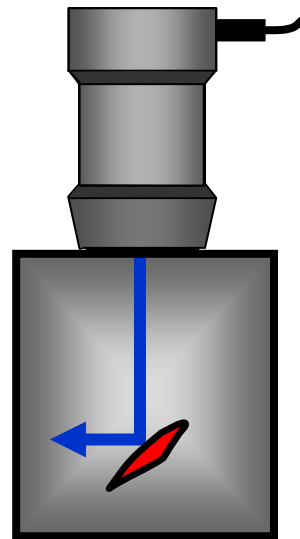


Ultraschall an Grenzschichten, Brechung

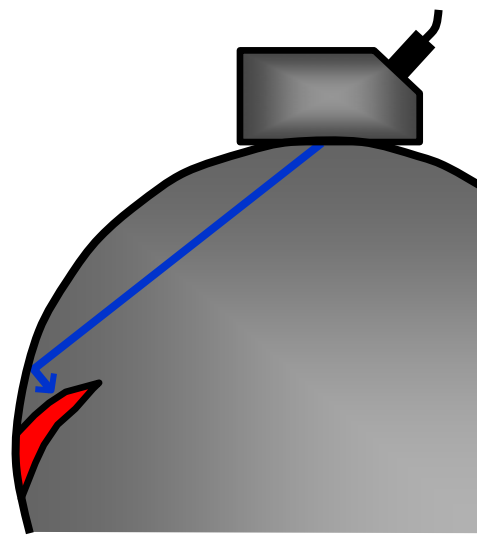
Anzeige
ok



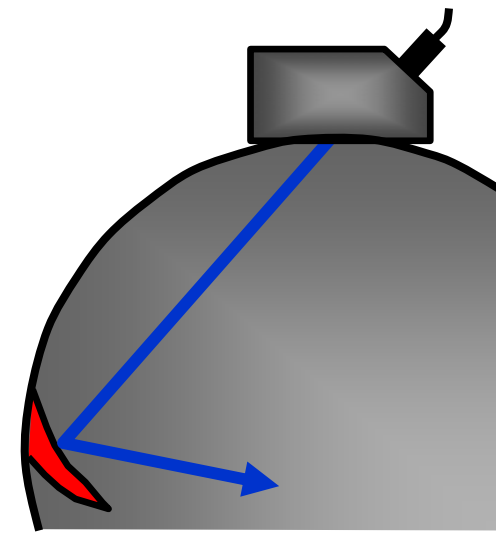
keine
Anzeige



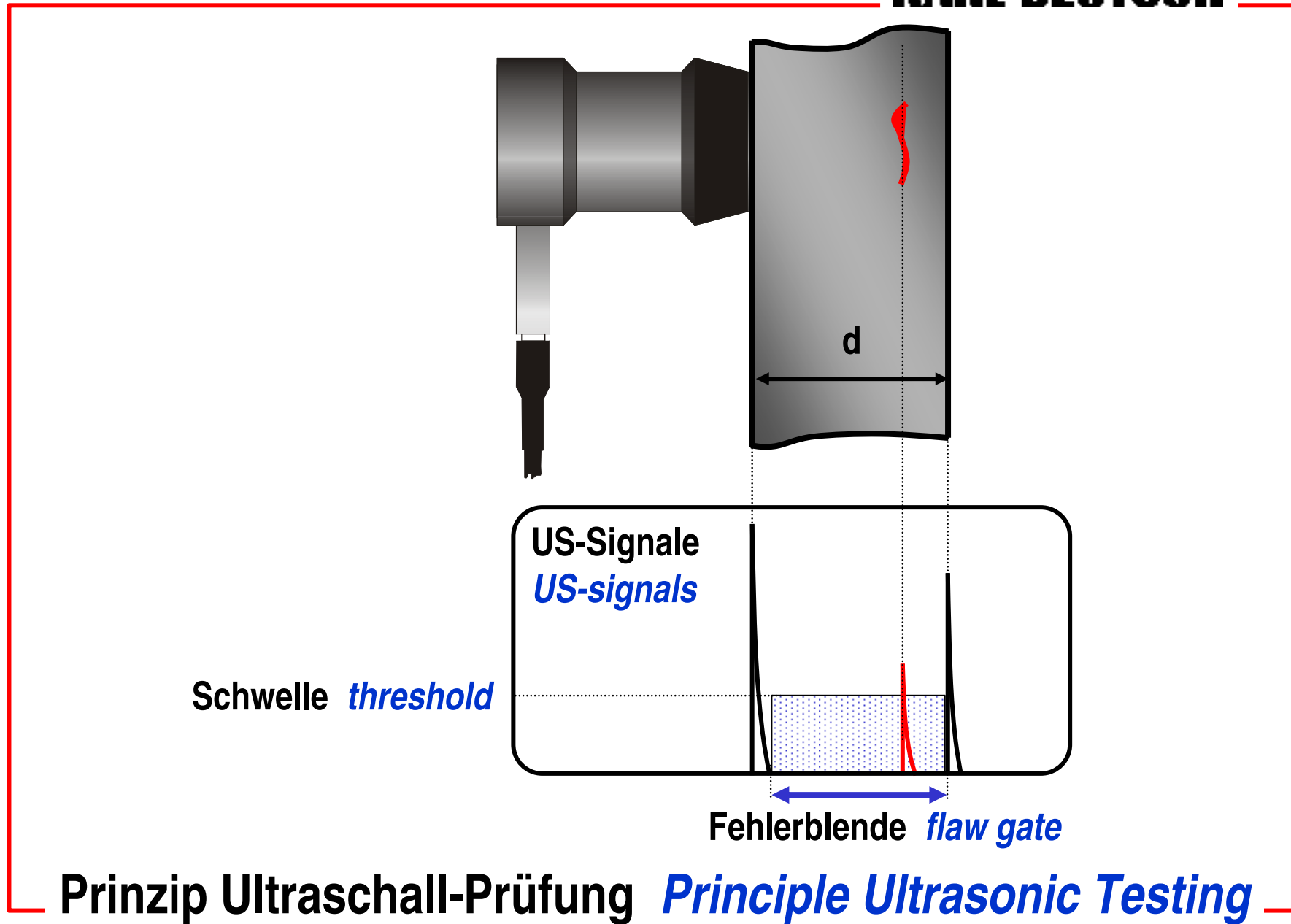
Anzeige
ok



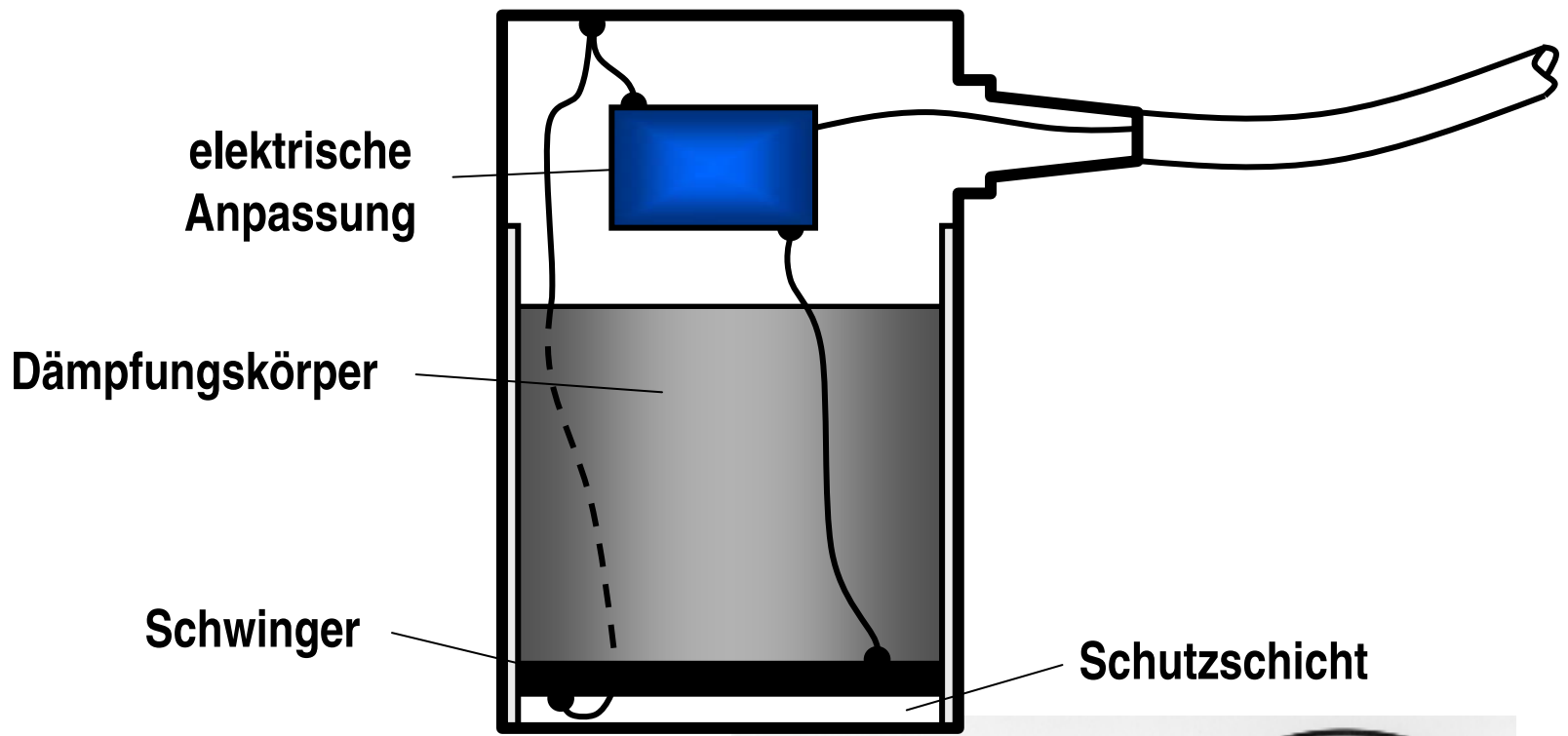
keine
Anzeige



Ultraschall-Reflexion an Fehlstellen



Prinzip Ultraschall-Prüfung *Principle Ultrasonic Testing*



Senkrechtprüfköpfe

Auswahlkriterien:

- Frequenz (Material, Eindringtiefe, Empfindlichkeit)
- Baugröße (Intensität)
- Einschallwinkel (Anwendung)
- Schallfeldbreite, Fokus

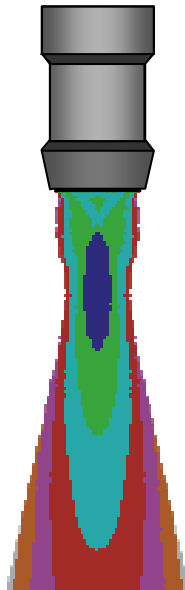
Criteria of Choice:

- *frequency (material, penetration depth, sensitivity)*
- *probe size (intensity)*
- *incidence angle (application)*
- *width of sound field, focus*

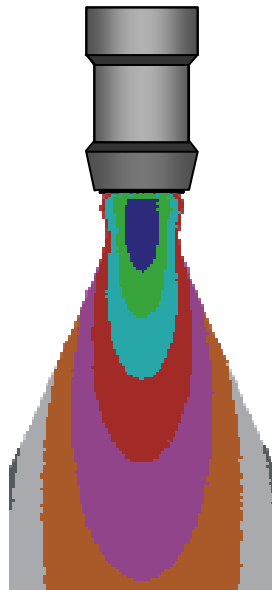


ECHOGRAPH Ultraschall-Prüfköpfe *ECHOGRAPH Ultrasonic Probes*

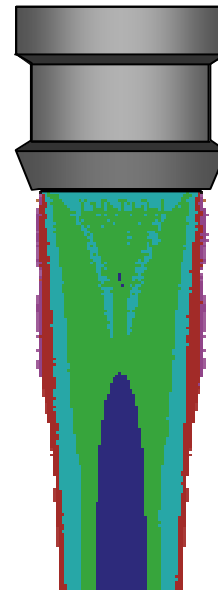
Ø = 12 mm
f = 2 MHz
Stahl



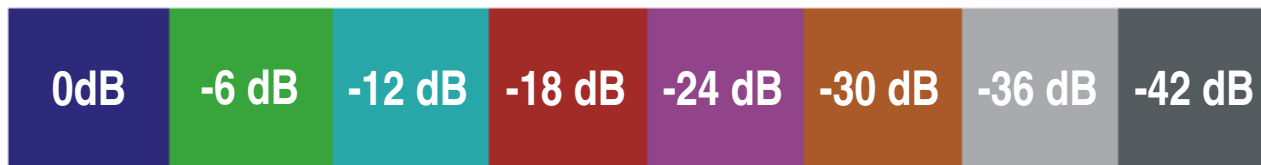
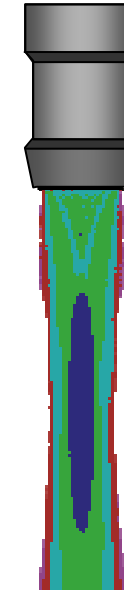
Ø = 12 mm
f = 1 MHz
Stahl



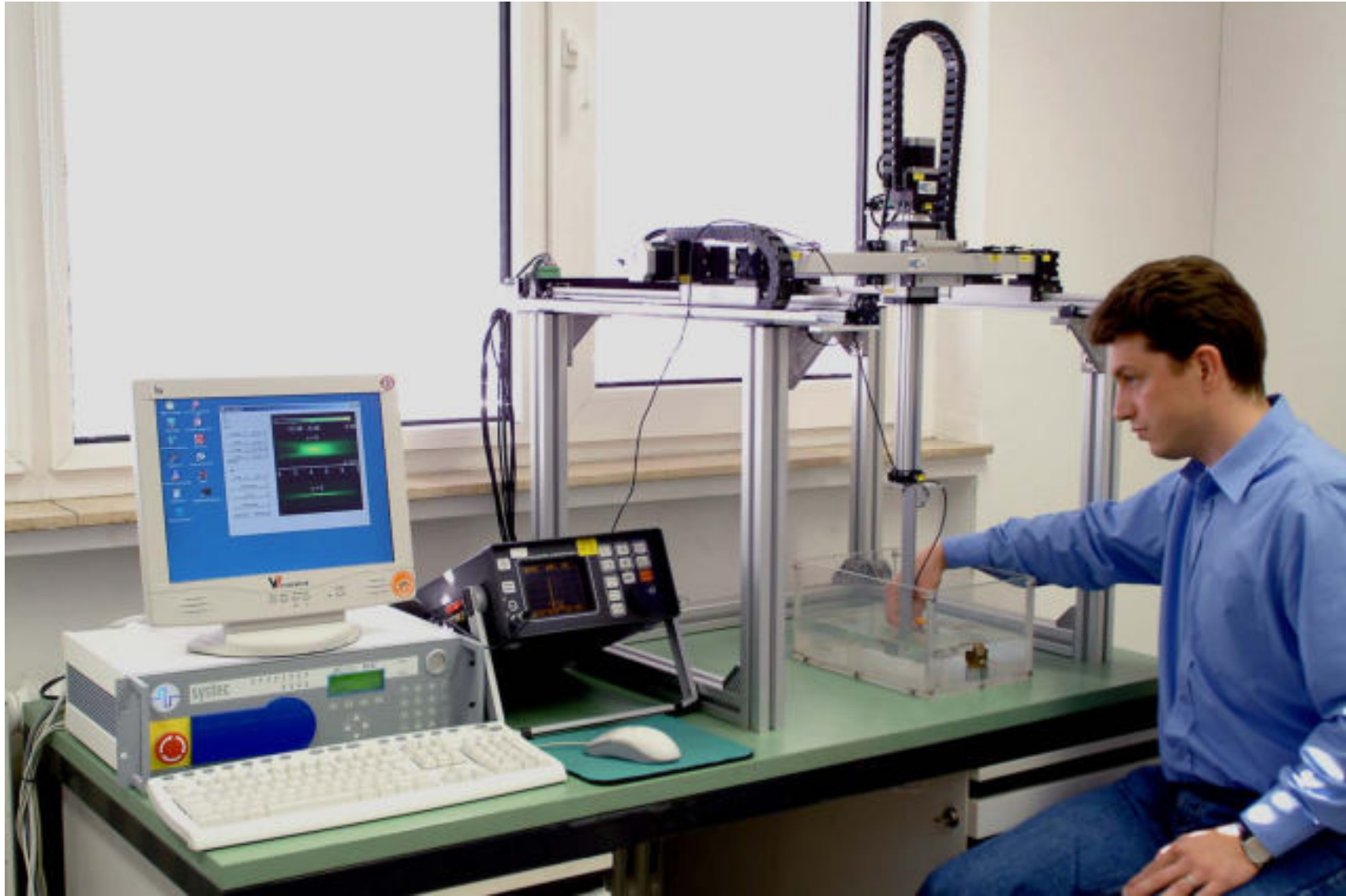
Ø = 24 mm
f = 2 MHz
Stahl



Ø = 12 mm
f = 2 MHz
Plastik



Schallfeld (abh. von Schwinger Ø, Frequenz, Schallgeschw.)

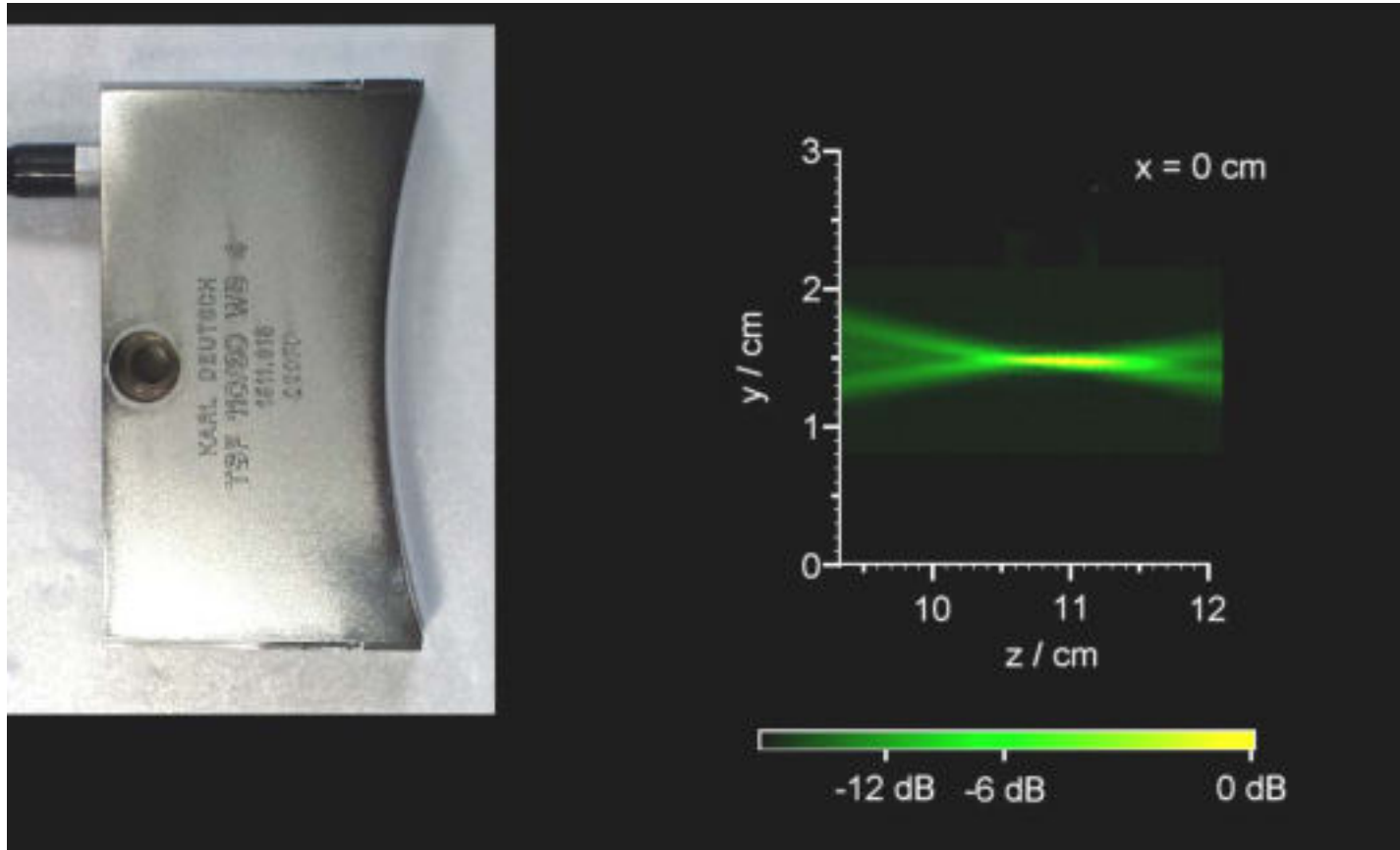


Schallfeldvermessung (3 Achsen) *Sound field measurement (3 axis)*

Linienfokus - Prüfkopf

Line focussed probe

TSF 110/30 WB 4 (z = 110 mm)



Schallfeldvermessung *Sound field measurement*

Aufbau Piezo-Komposite:

- gesägte Keramik-Stäbchen
- verfüllt mit Epoxidharz

Tauchtechnik STS 12 WB 4 C:

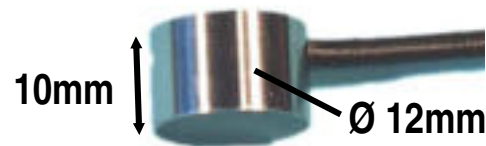
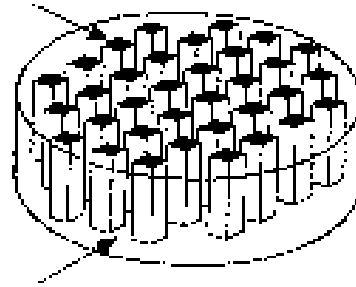
- Stangenprüfung, 4 MHz
- kurzes Gehäuse
- kein Dämpfungskörper

SE-Prüfkopf 3TSE18.3/10 PB5 C:

- Grobblech-Prüfung, 5 MHz
- schmale Schwinger (3 mm)
- hohe Empfindlichkeit
- hohe Gleichmäßigkeit (Laufzeit, Schielwinkel)

Mehrfach-PK 8TS 12.6 WB 4 C:

- Rohr-Prüfung, 4 MHz
- gleichmäßige Elemente
- wenig Übersprechen



Principle Piezo-Composite:

- ceramic cut into matrix
- filled with epoxy

Immersion Probe STS 12 WB 4 C:

- bar testing, 4 MHz
- short housing
- no backing required

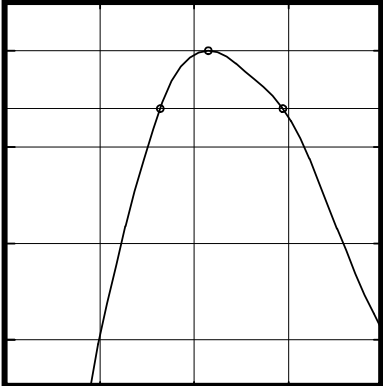
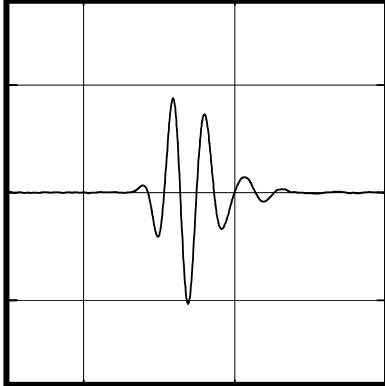
TR-Probe 3TSE18.3/10 PB5 C:

- heavy strip testing, 5 MHz
- narrow active elements (3 mm)
- high sensitivity
- high uniformity of elements (amplitude, incidence angle)

Multi-Probe 8TS 12.6 WB 4 C:

- tube testing, 4 MHz
- uniform elements
- little cross-talk

Composite-Prüfköpfe **Composite Probes**

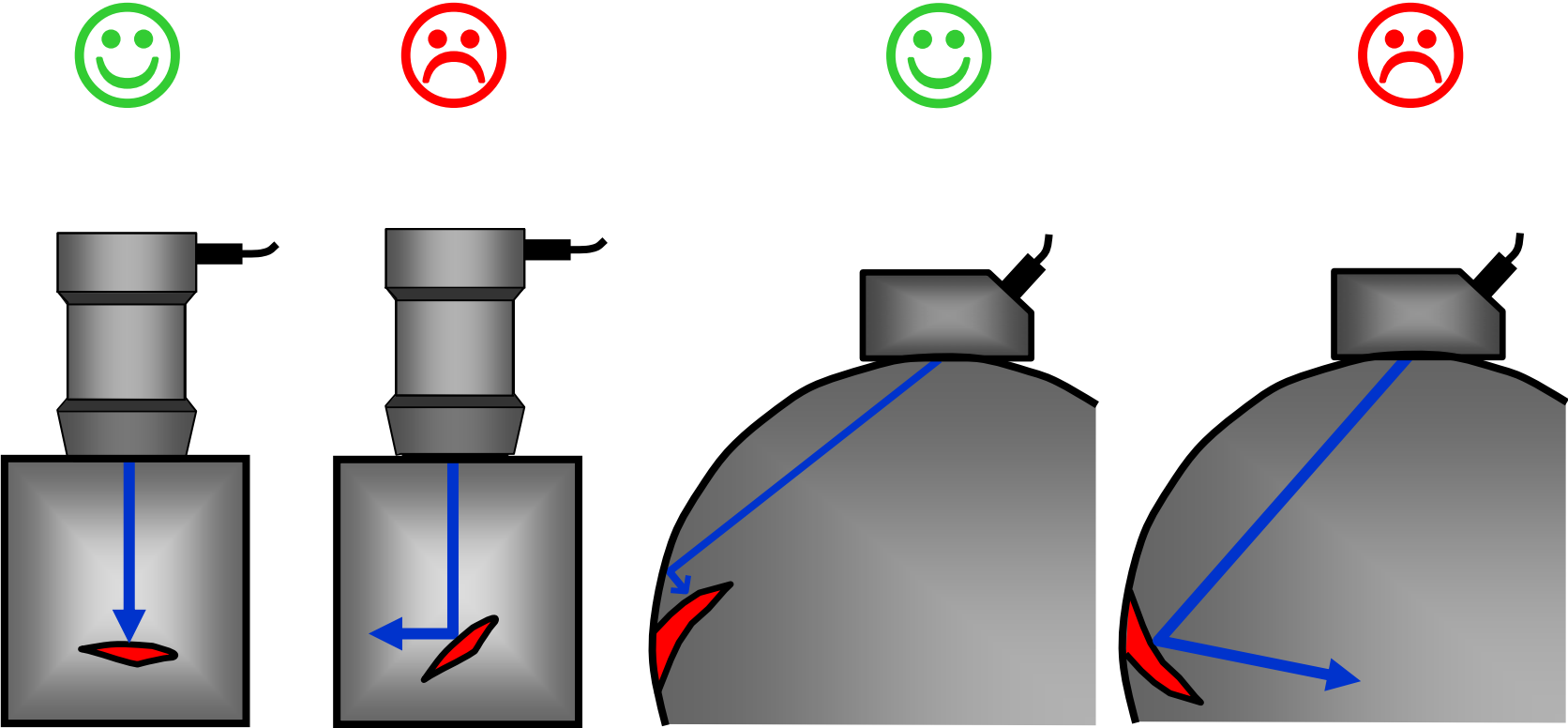


Spezial-Prüfköpfe *Special Probes*

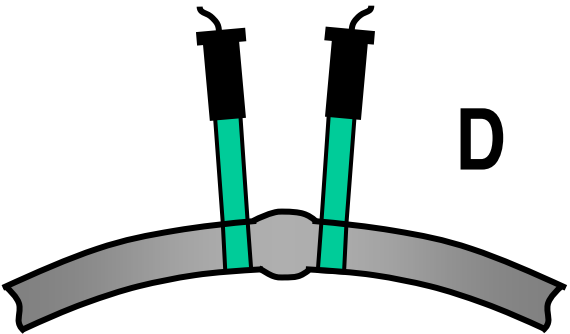
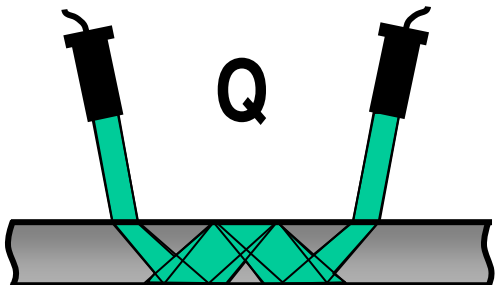
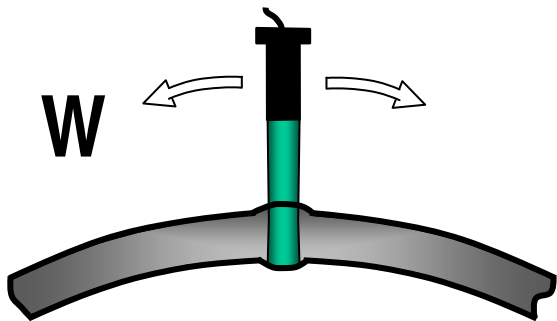
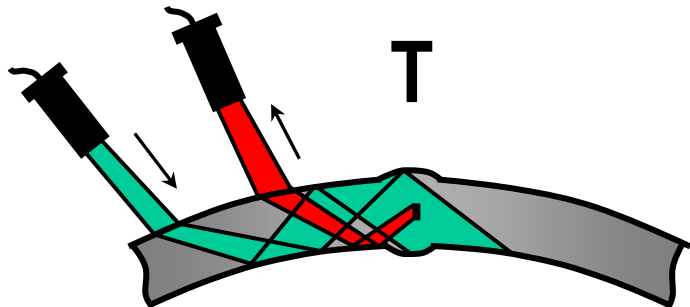
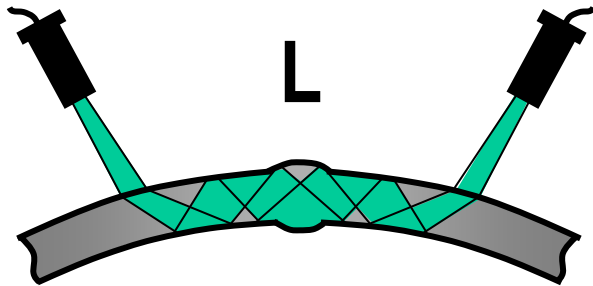
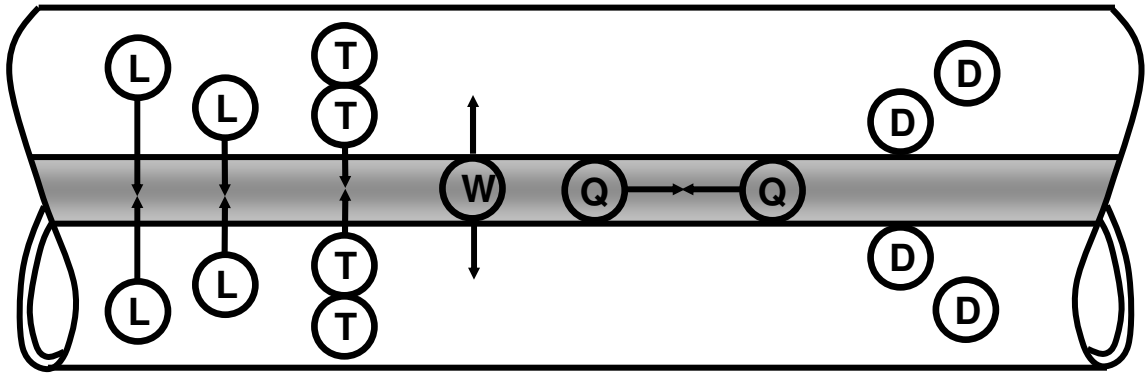
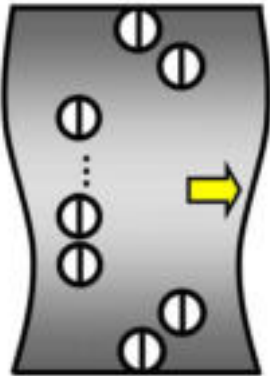


Prüfaufgaben Schweißnaht

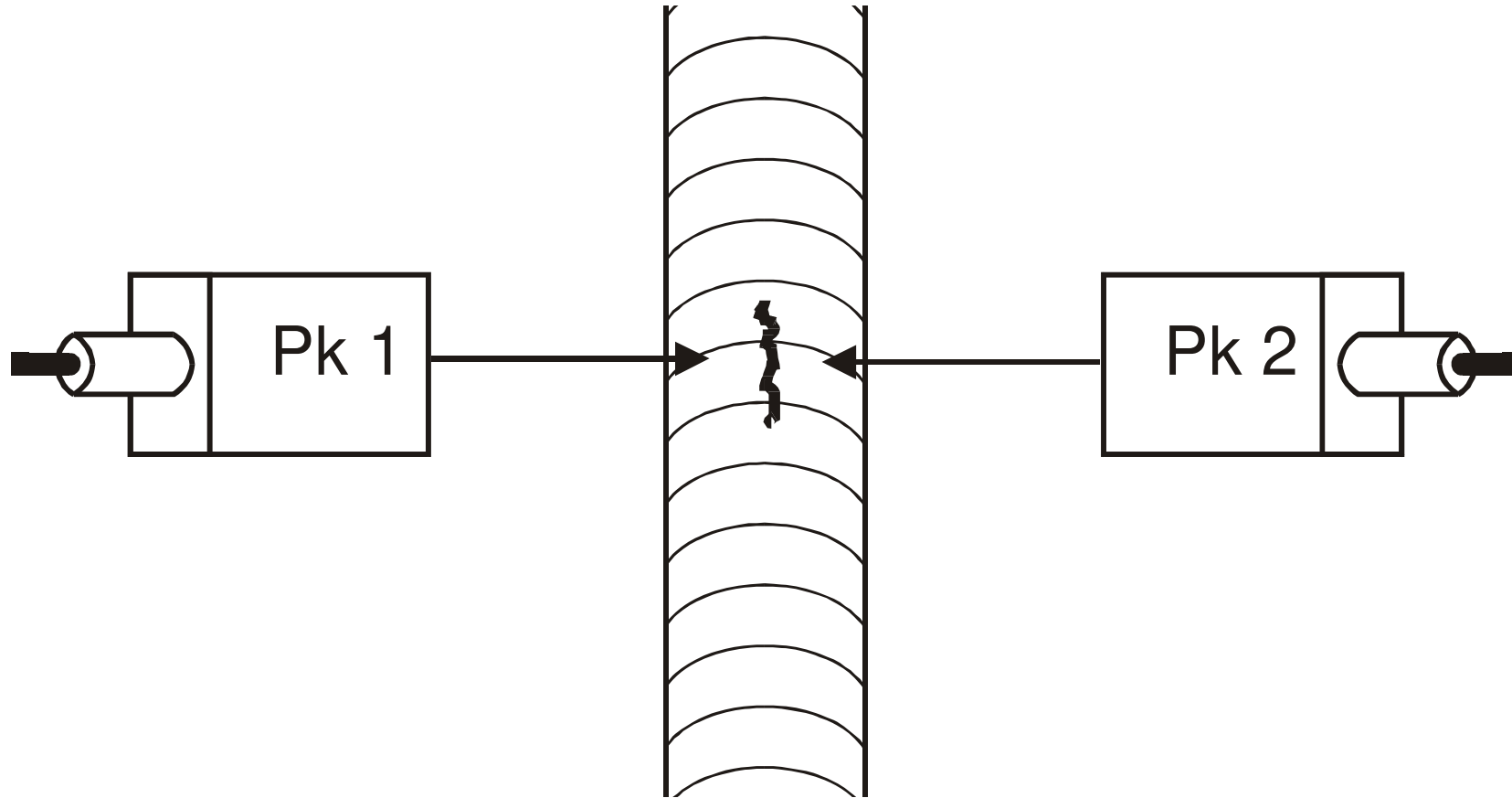
Test Task: Weld Test



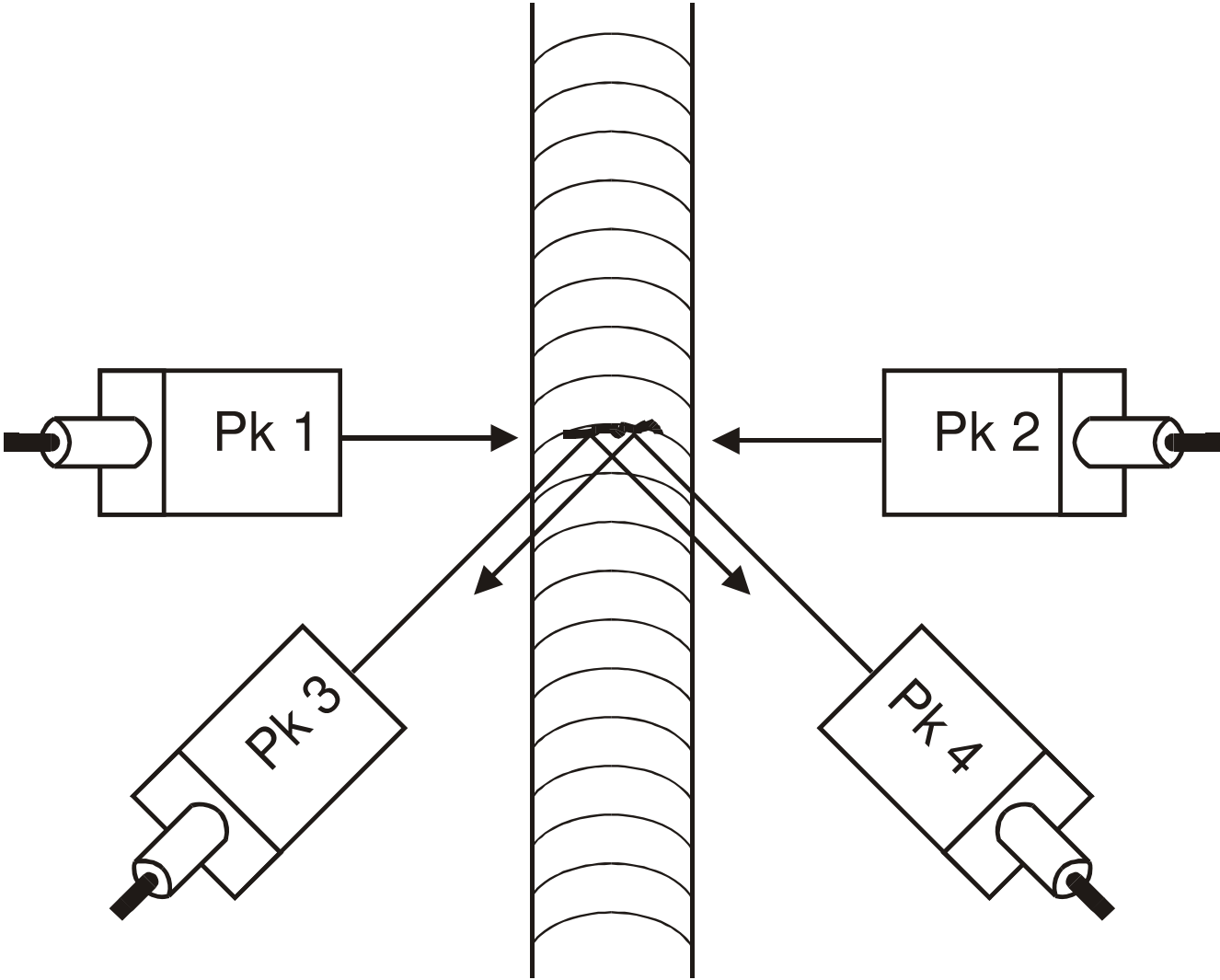
Ultraschall-Reflexion an Fehlstellen *UT-Reflections from Cracks*



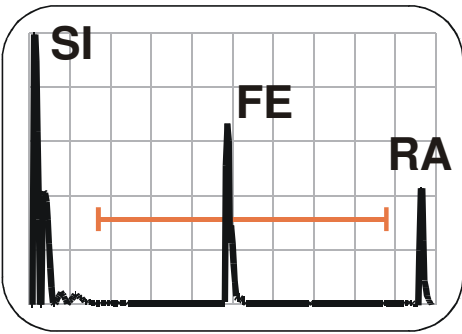
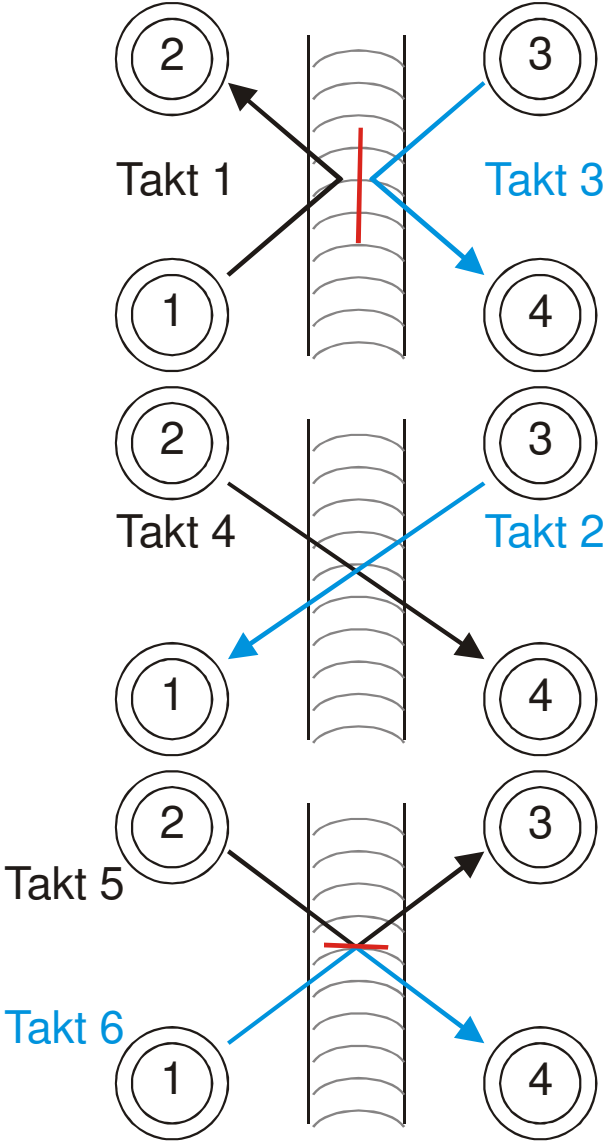
Prüfungsaufgaben *Test Tasks @ Welded Pipe*



Längsfehler-Prüfung *Longitudinal Flaw Detection*

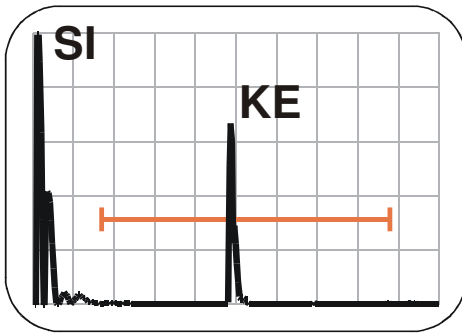


K-Anordnung *K-Configuration*



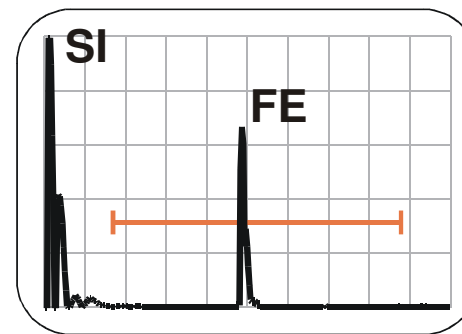
Längsfehler

SI = Sendepuls
FE = Fehlerecho
RA = Raupeanzeige



Koppelkontrolle

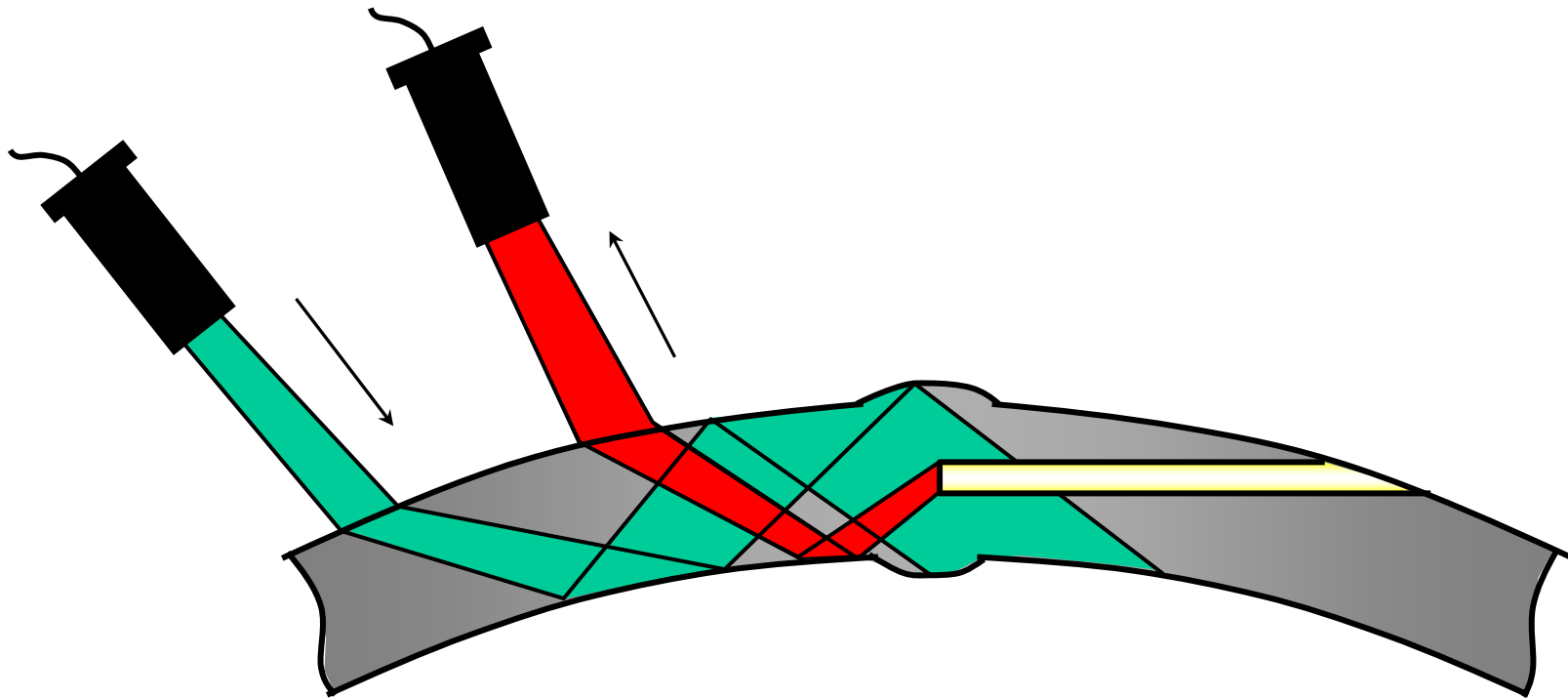
SI = Sendepuls
KE = Koppelecho



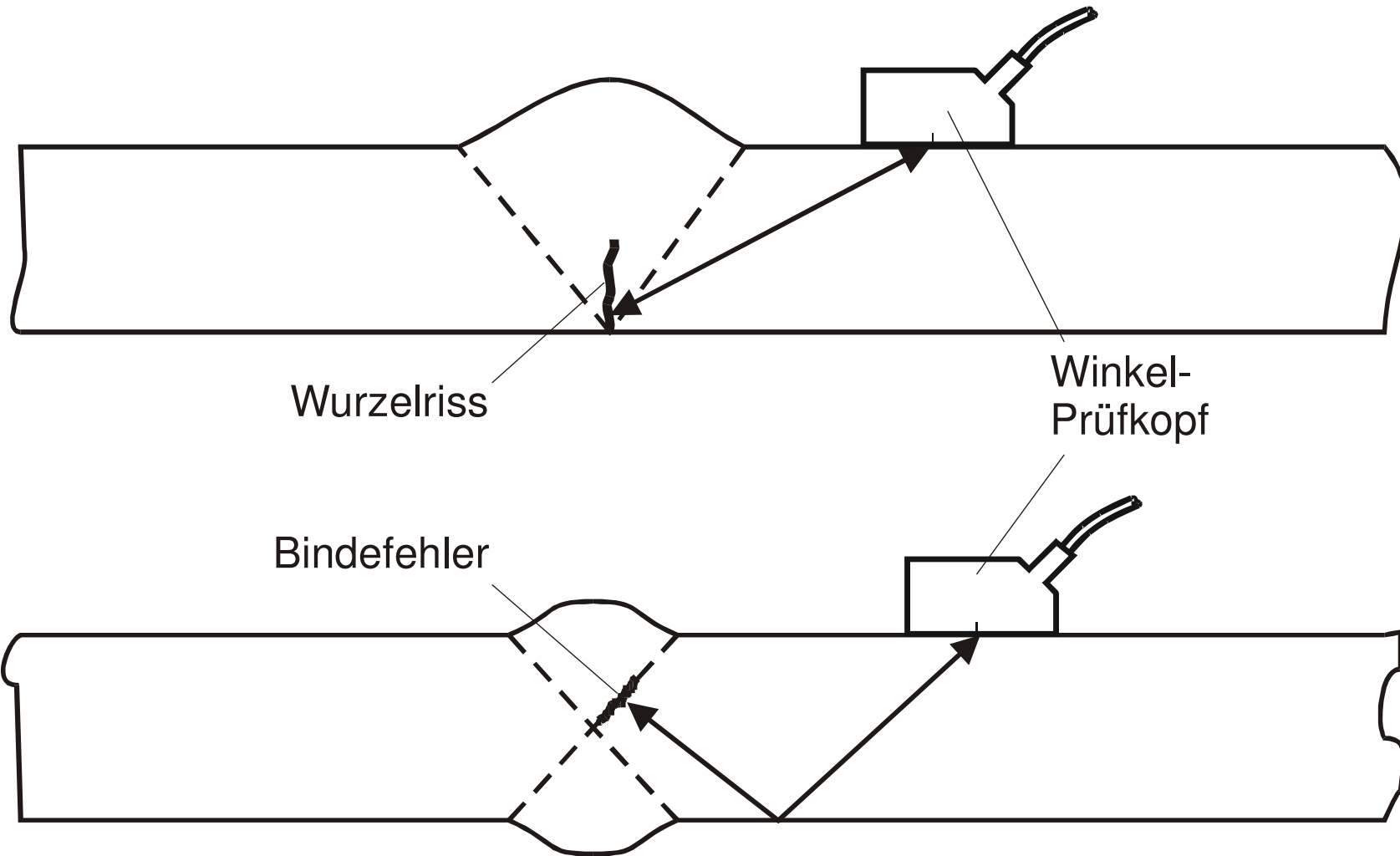
Querfehler

SI = Sendepuls
FE = Fehlerecho

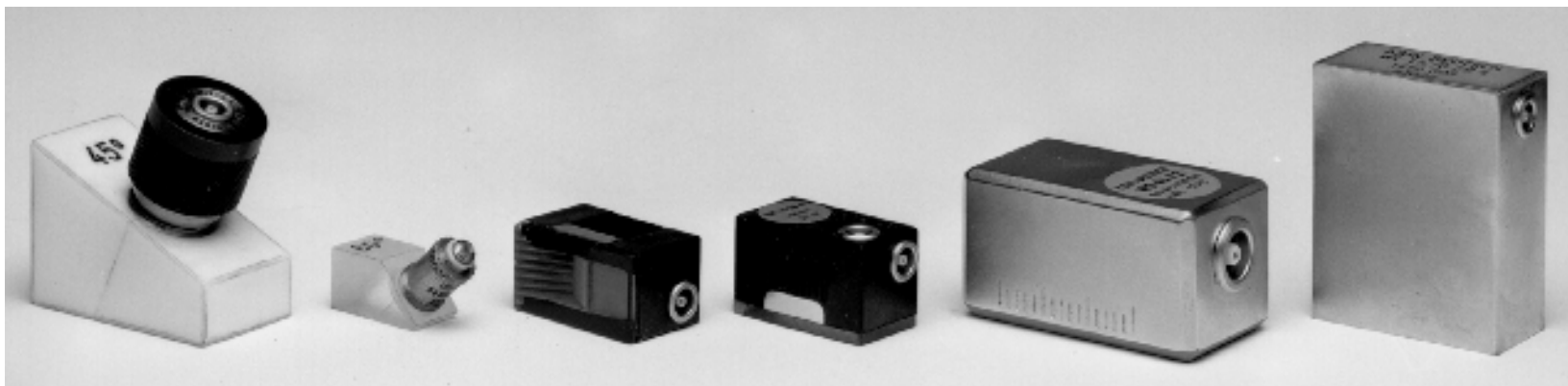
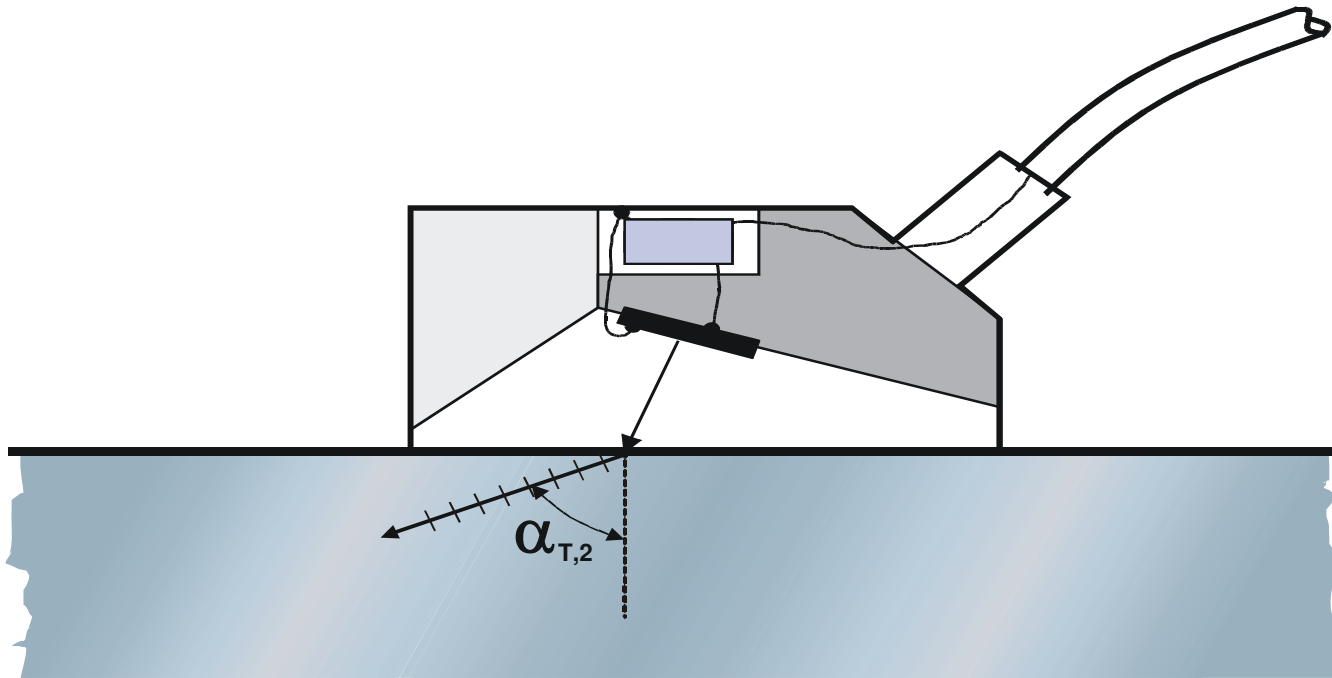
X-Anordnung *X-Configuration*



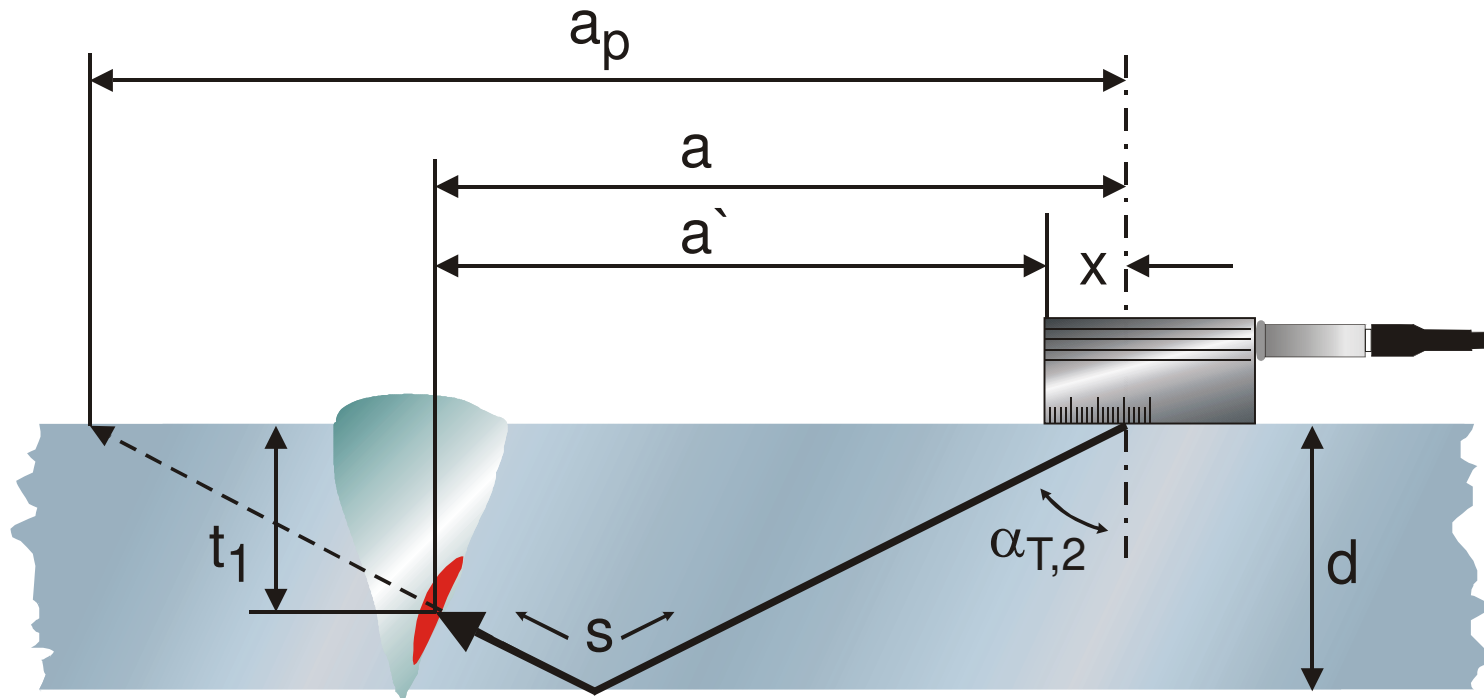
Tandem-Test Defect 3.2mm FBH (SHELL)



Schweißnahtprüfung mit Winkelprüfkopf



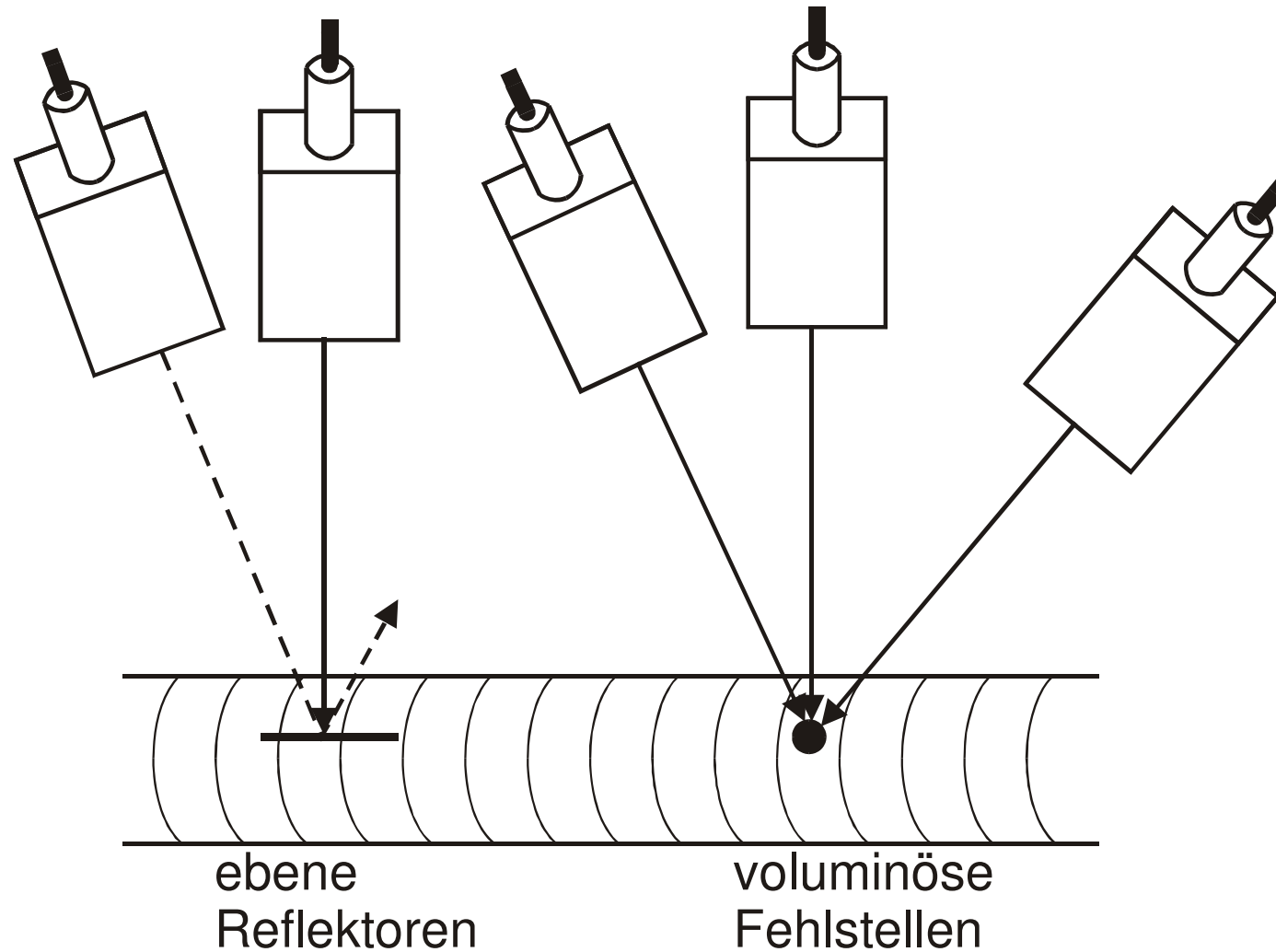
Winkelprüfköpfe



Winkelprüfkopf

- s = Schallweg
- $a = s \sin(\alpha)$ = Projektionsabstand
- $a' = a - x$ = verk. Projektionsabst.
- $a_p = 2d \tan(\alpha)$ = Sprungabstand
- $t_0 = s \cos(\alpha)$ = Tiefenmaß
- $t_1 = 2d - s \cos(\alpha)$ = Tiefenmaß über Sprung

Formeln für Winkelprüfkopf



Einschallrichtung & Fehlertyp



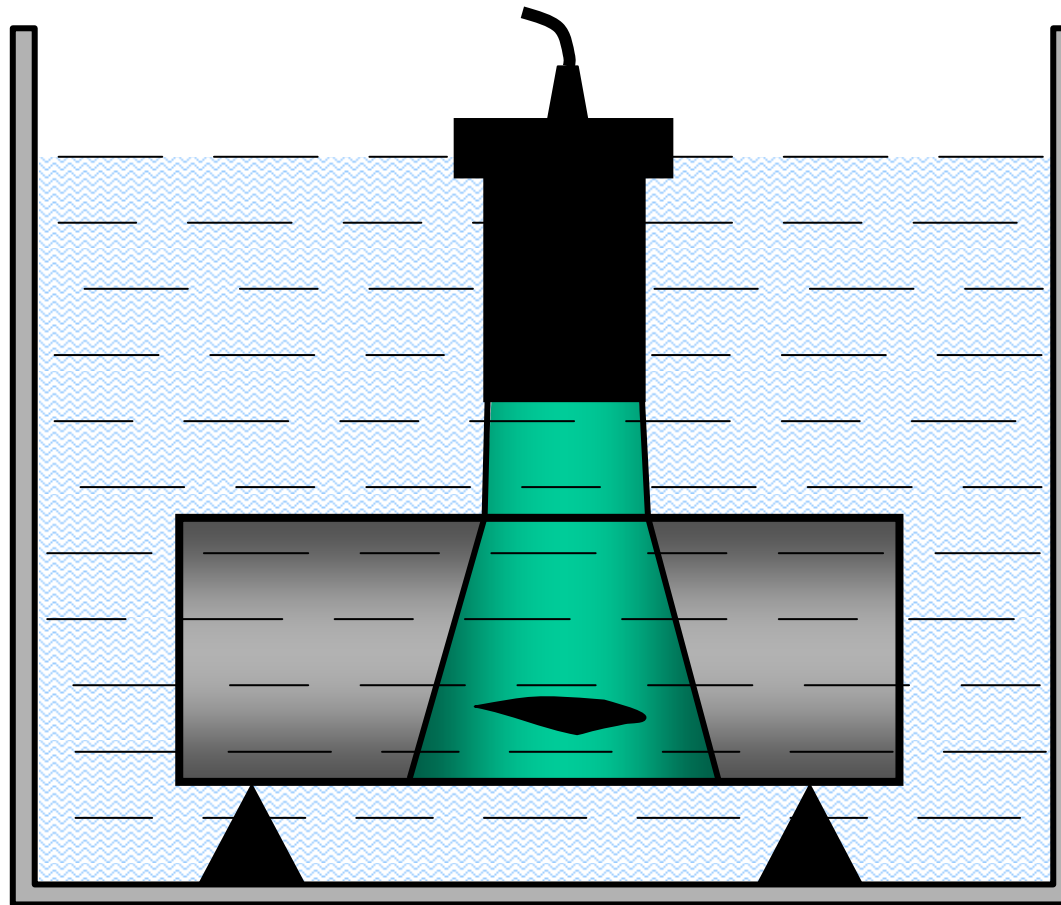
Ultraschall-Schweißnahtprüfung am Drehgestell



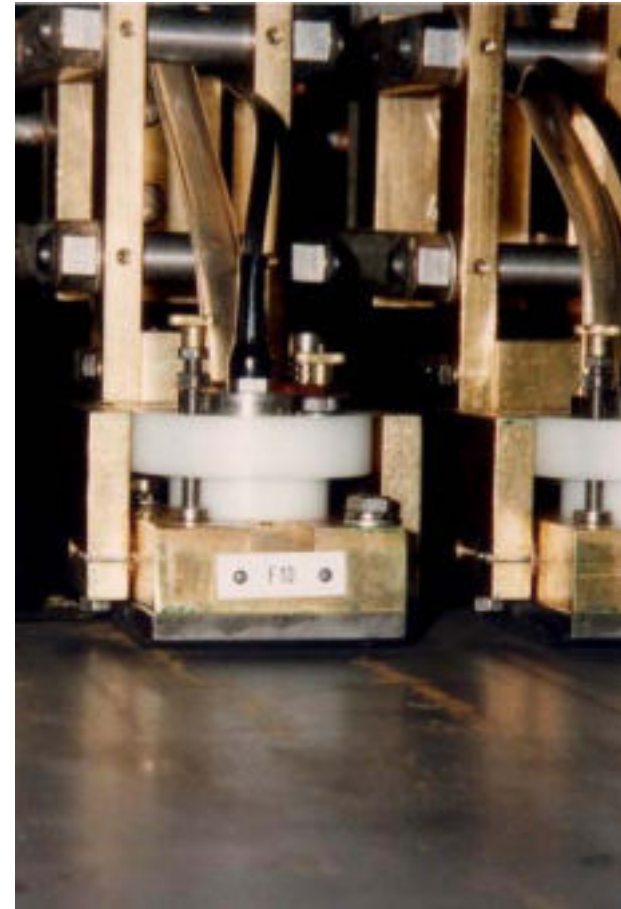
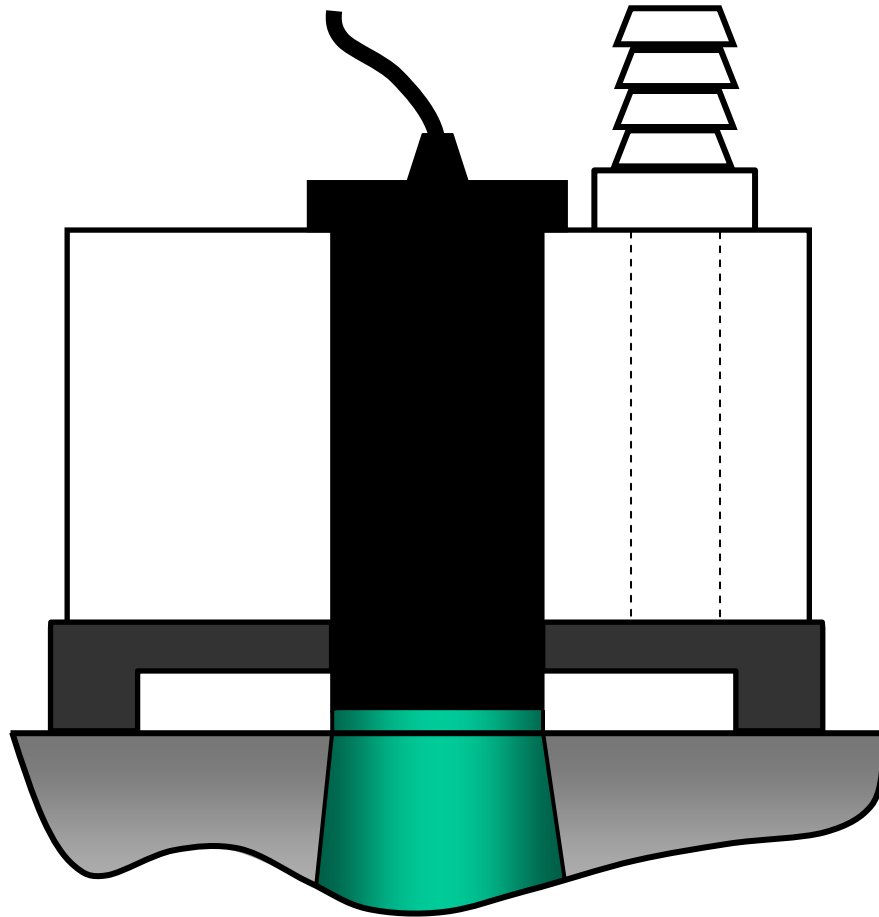
UT-Schweißnahtprüfung im Stadium (SLV München)



Ankopplung Ultraschall Ultrasonic Coupling



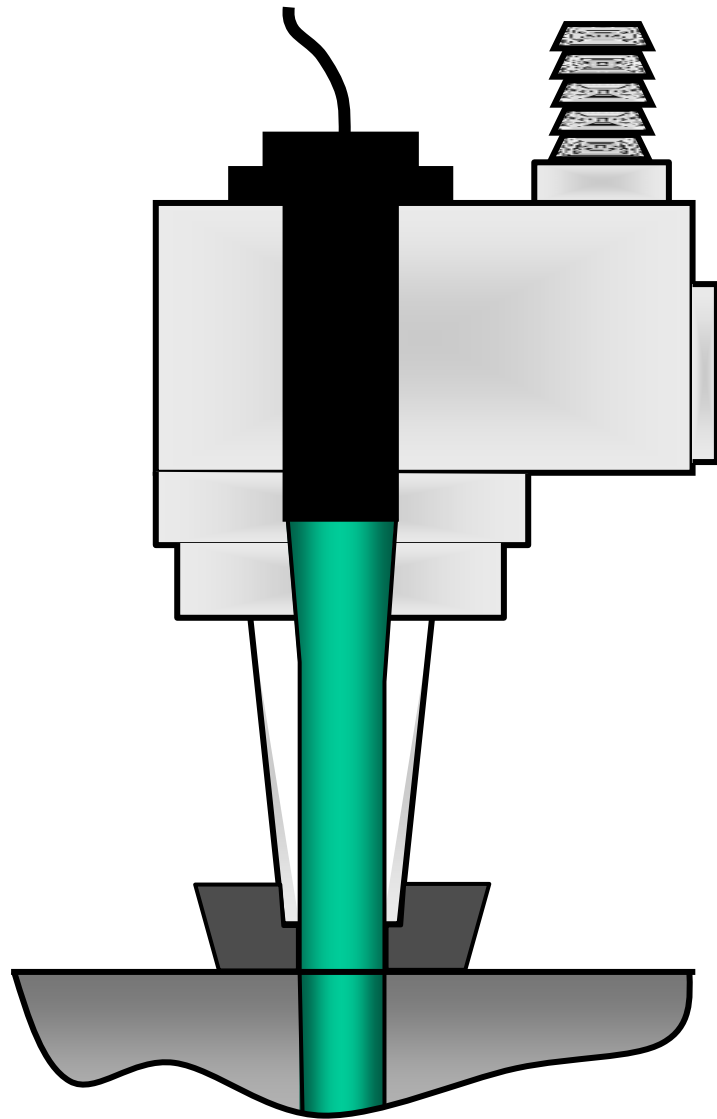
Tauchtechnik *Immersion Testing*



Wasserspalt-Ankopplung *Water Gap Coupling*



Spaltankopplung *Gap Coupling*



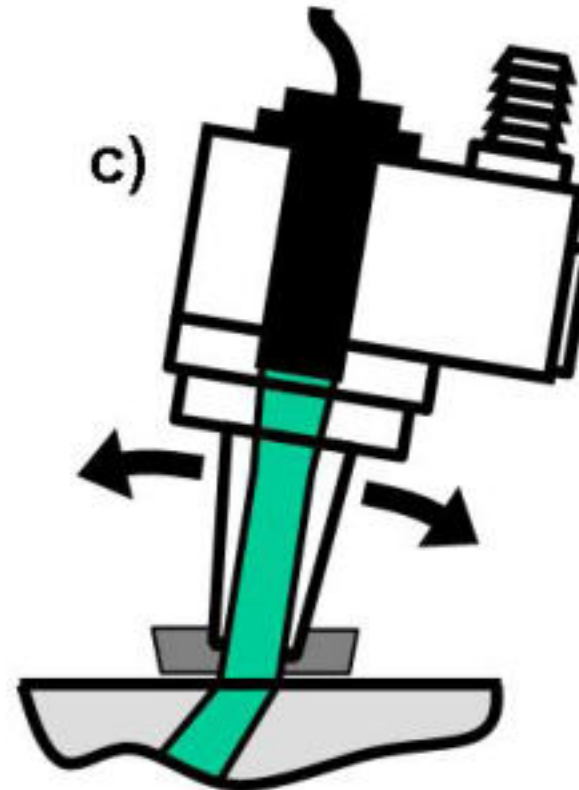
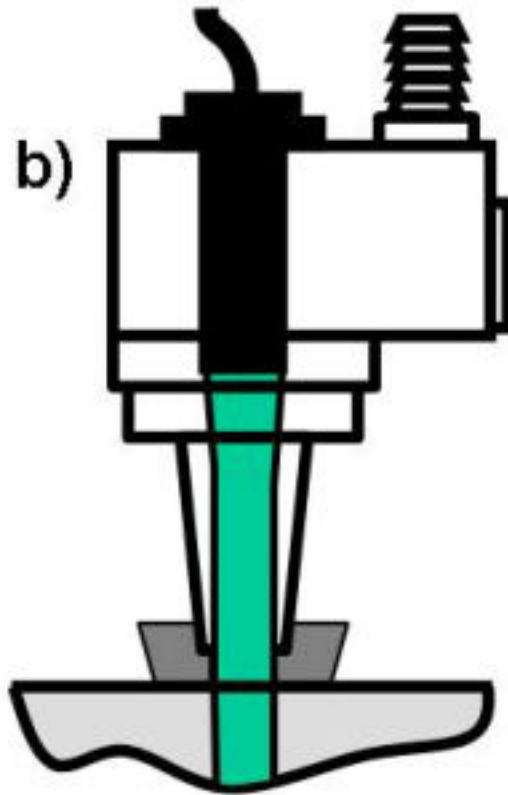
- Düse für Wasserstrahl
- Führung des Prüfkopfträgers
z.B. durch Gleitkufen/Gleitrollen
- schmaler Spalt zwischen Kufe & Prüfling

- *nozzle for water jet guidance*
- *guidance of probe carrier
e.g. with skids or rollers*
- *small gap between nozzle and specimen*

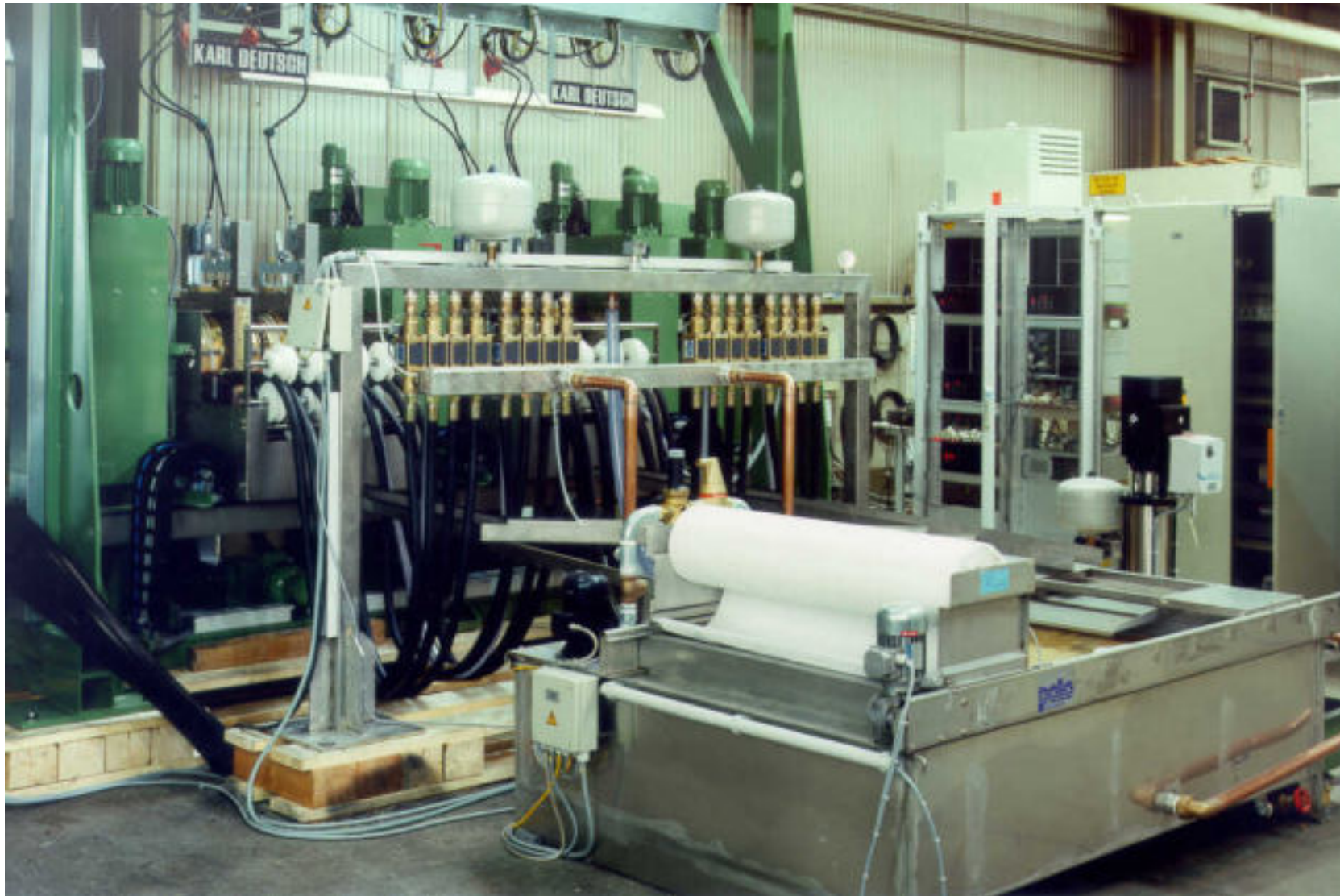
Wasserstrahl-Ankopplung *Water Jet Coupling*

- auch für Winkel-Einschallung
- Stangen-Prüfung
- Schweißnaht-Prüfung

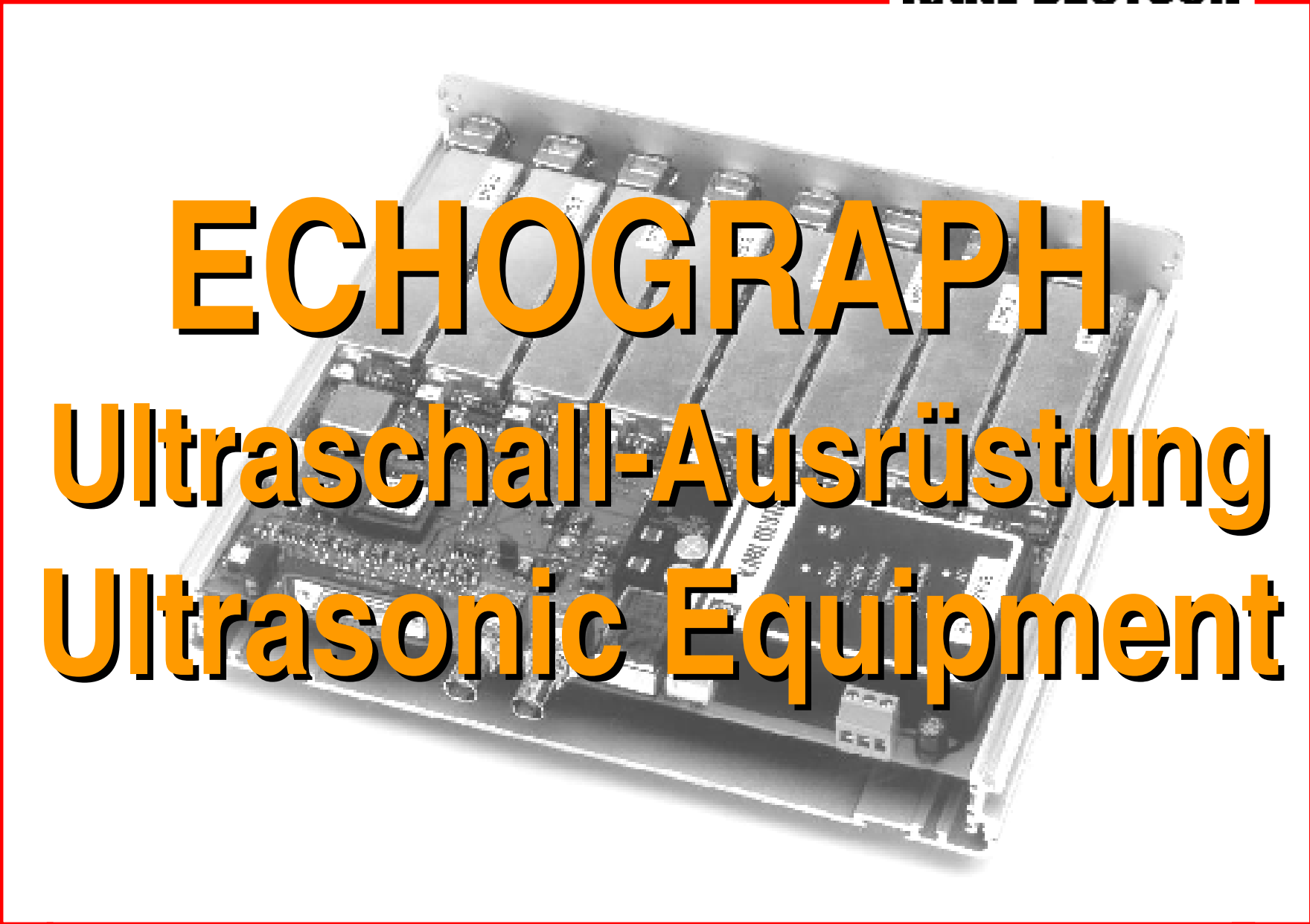
- *also for Angular Incidence*
 - *bar testing*
 - *weld testing*



Wasserstrahl-Ankopplung *Water Jet Coupling*



Koppelmittel-Filter *coupling agent filter*

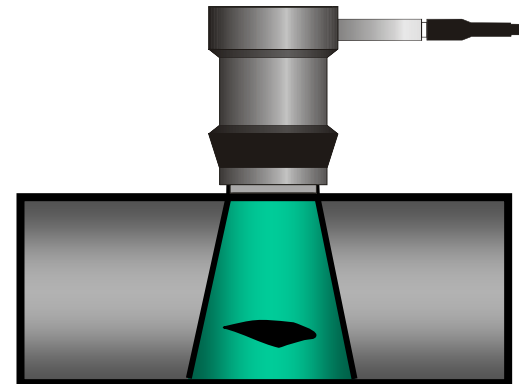


ECHOGRAPH
Ultraschall-Ausrüstung
Ultrasonic Equipment

KARL DEUTSCH

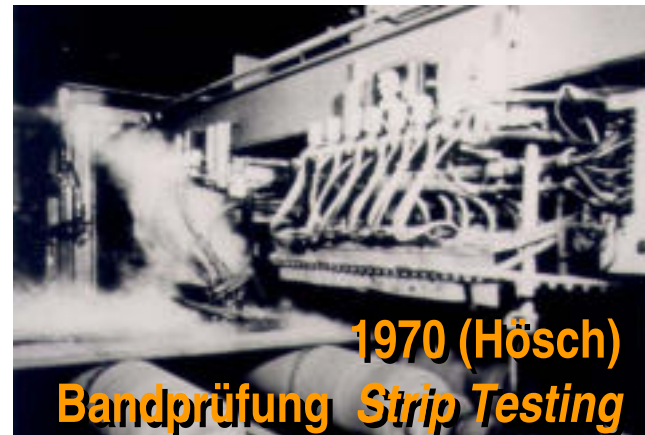
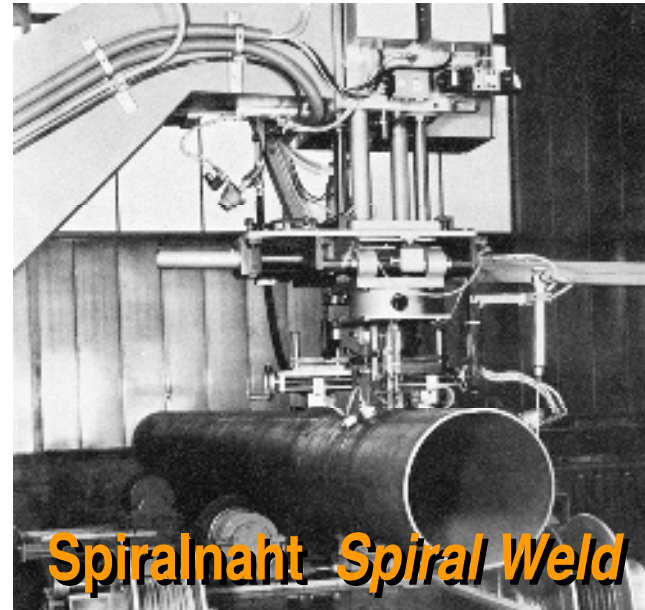
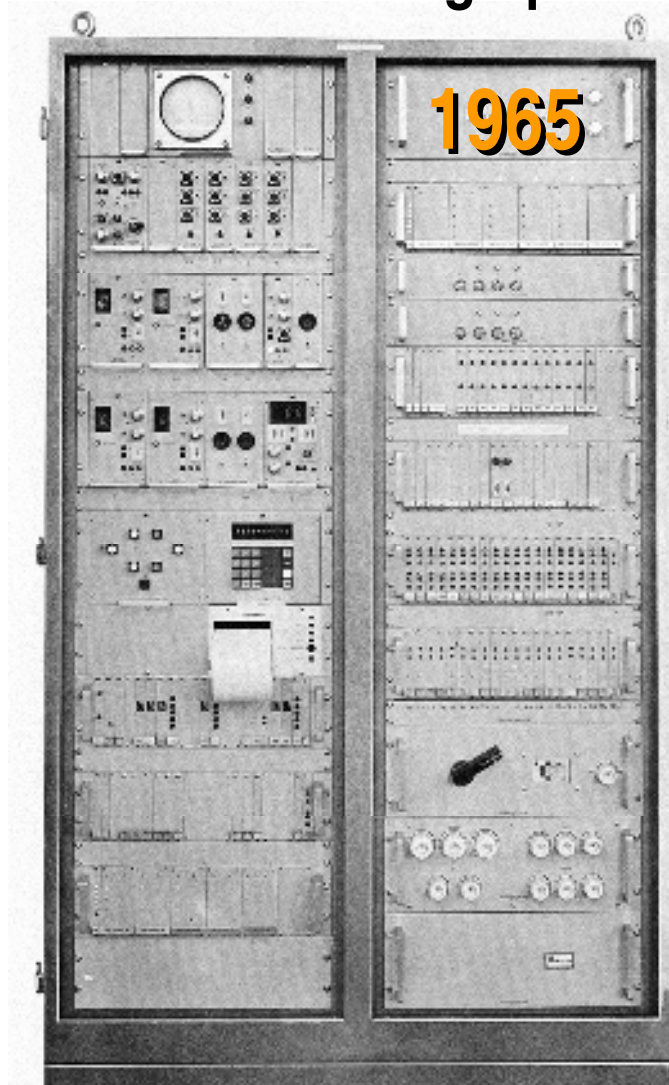


5 Jahrzehnte Ultraschall-Prüfung
5 Decades of Ultrasonic Testing



Karl Deutsch ECHOGRAPH

Echograph 1140 System-Electronics



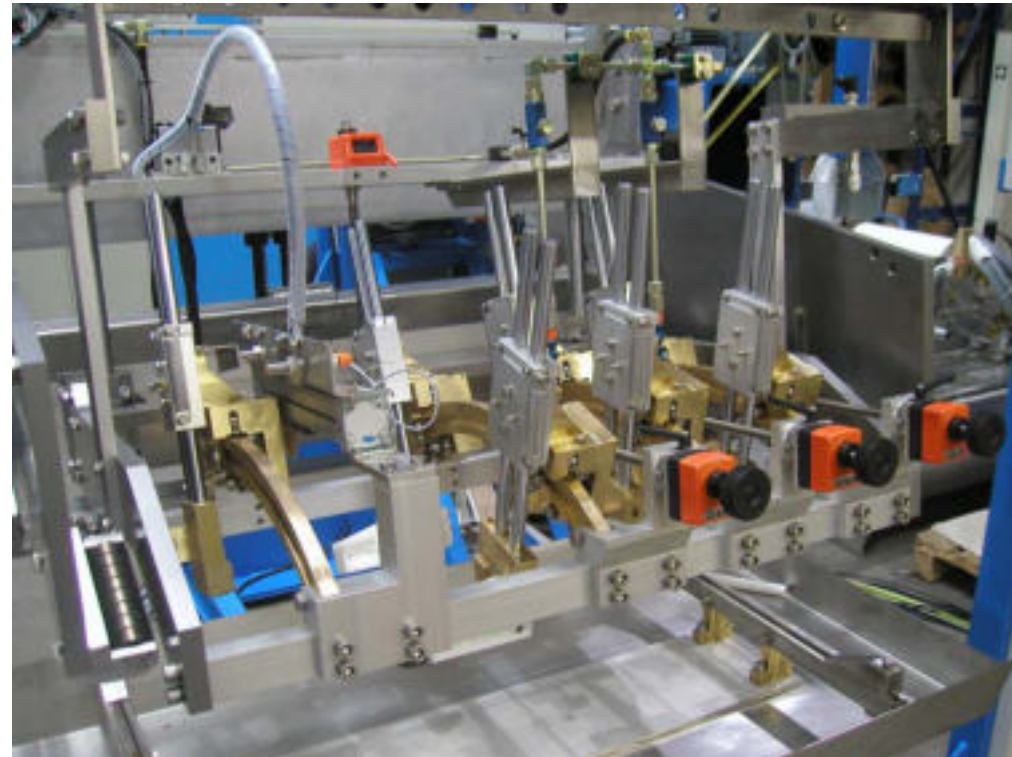
40 Jahre Erfahrung Schweißnaht-Prüfung *40 Years Experience on Weld Testing*

KARL DEUTSCH

Rechnergestützte Anlagen-Elektronik @ Mannesmann
Micro-Processor Controlled System Electronics



ECHOGRAPH 1160 *ECHOGRAPH 1160*



4 * Longitudinal
2 * Dopplungen
1 * Schabekontrolle
 $\Sigma = 7$ Kanäle

4 * *Longitudinal*
2 * *Laminations*
1 * *Deburring Check*
 $\Sigma = 7$ *Channels*

ECHOGRAPH 1030-4L2DP1OSC

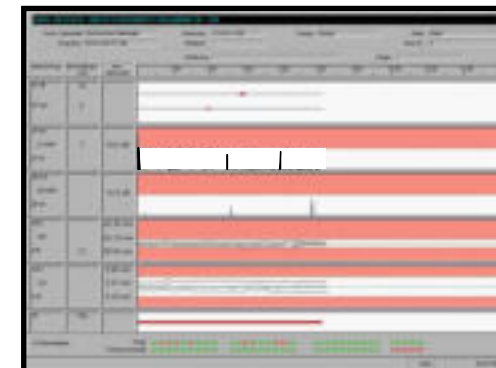
Technische Daten:

- 16 Kanäle / Modul
- 4 Blenden / Kanal
- 3 Schwellen
- 24 kHz Taktfrequenz
- Bestätigungsrate
- schneller Tiefenausgleich
- on-line Datenvisualisierung
- Windows-Datenverwaltung
- Archivierung in Datenbank
- Hostanbindung
- Ferndiagnose via Modem
- 40 Jahre Erfahrung



Technical Data:

- 16 channels / module
 - 4 gates / channel
 - 3 thresholds
- 24 kHz internal clock
 - noise suppression
- fast programmable DAC
- on-line data visualisation
- Windows-data management
 - data statistics & storage
 - host connection
- remote modem access
 - 40 years experience



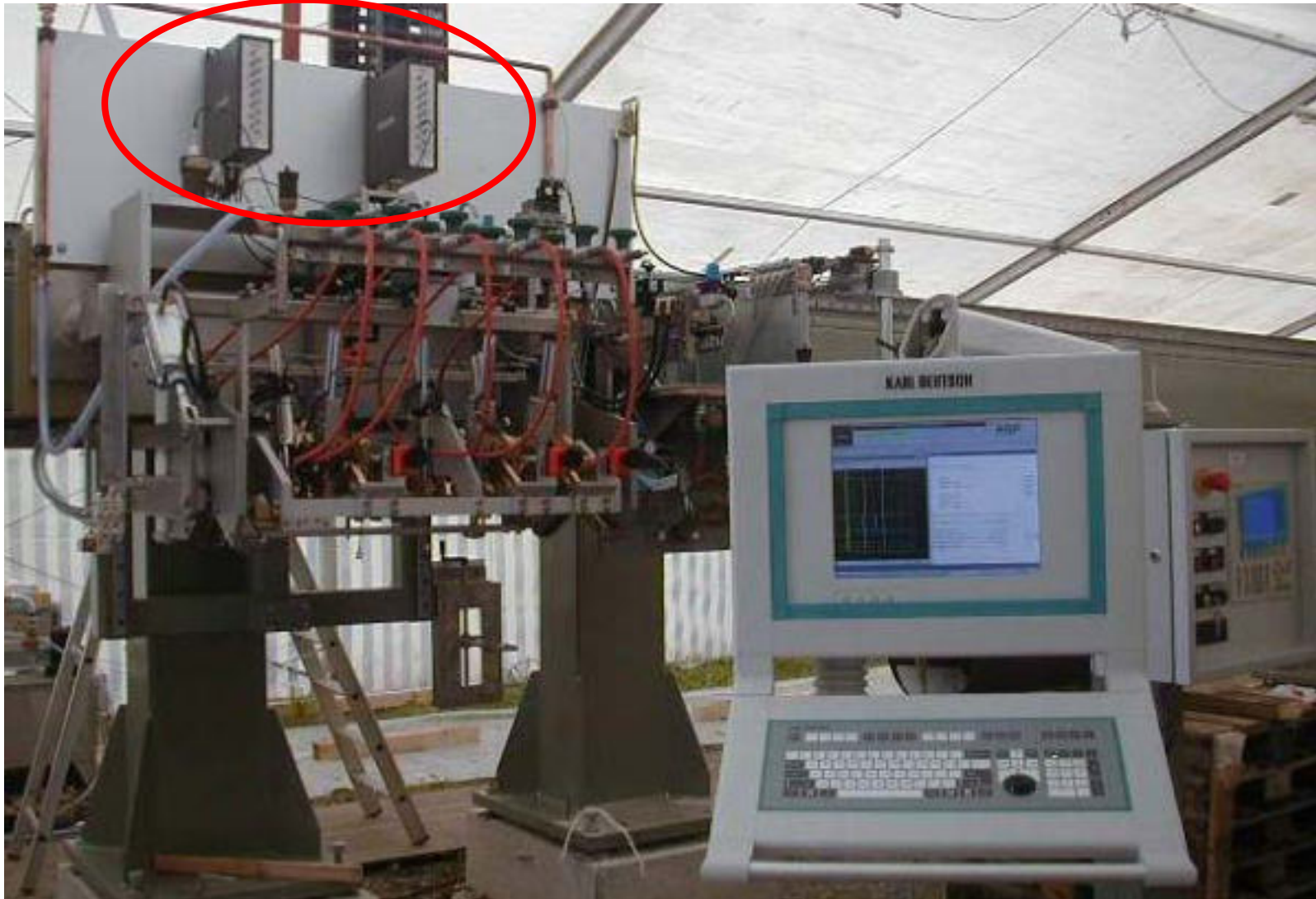
ECHOGRAPH 1155: Ultraschall-Elektronik *Ultrasonic Electronic*

KARL DEUTSCH



ECHOGRAPH 1155 Vorverstärker (IP 65)

KARL DEUTSCH

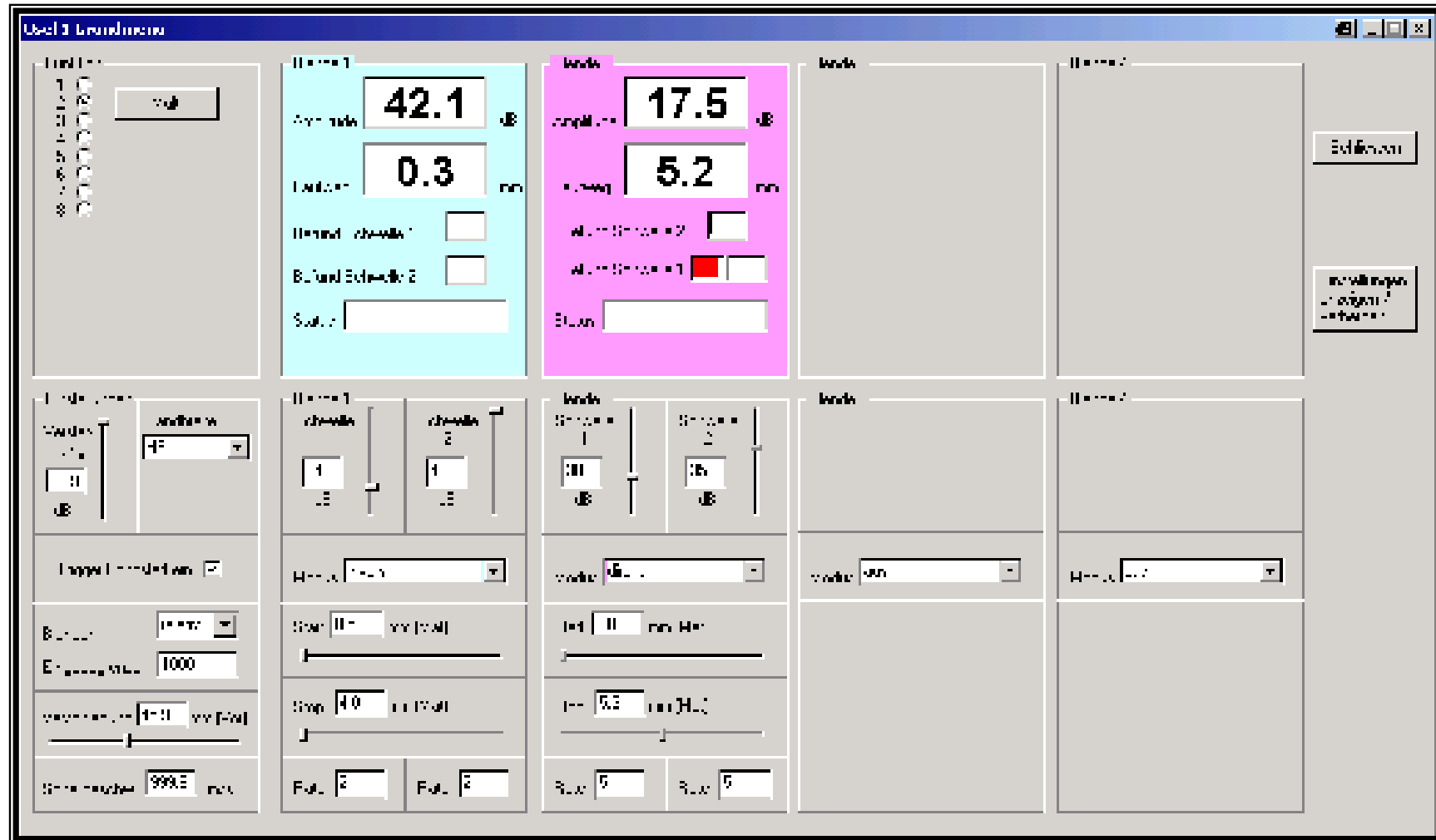


ECHOGRAPH 1155 Vorverstärker (IP 65)

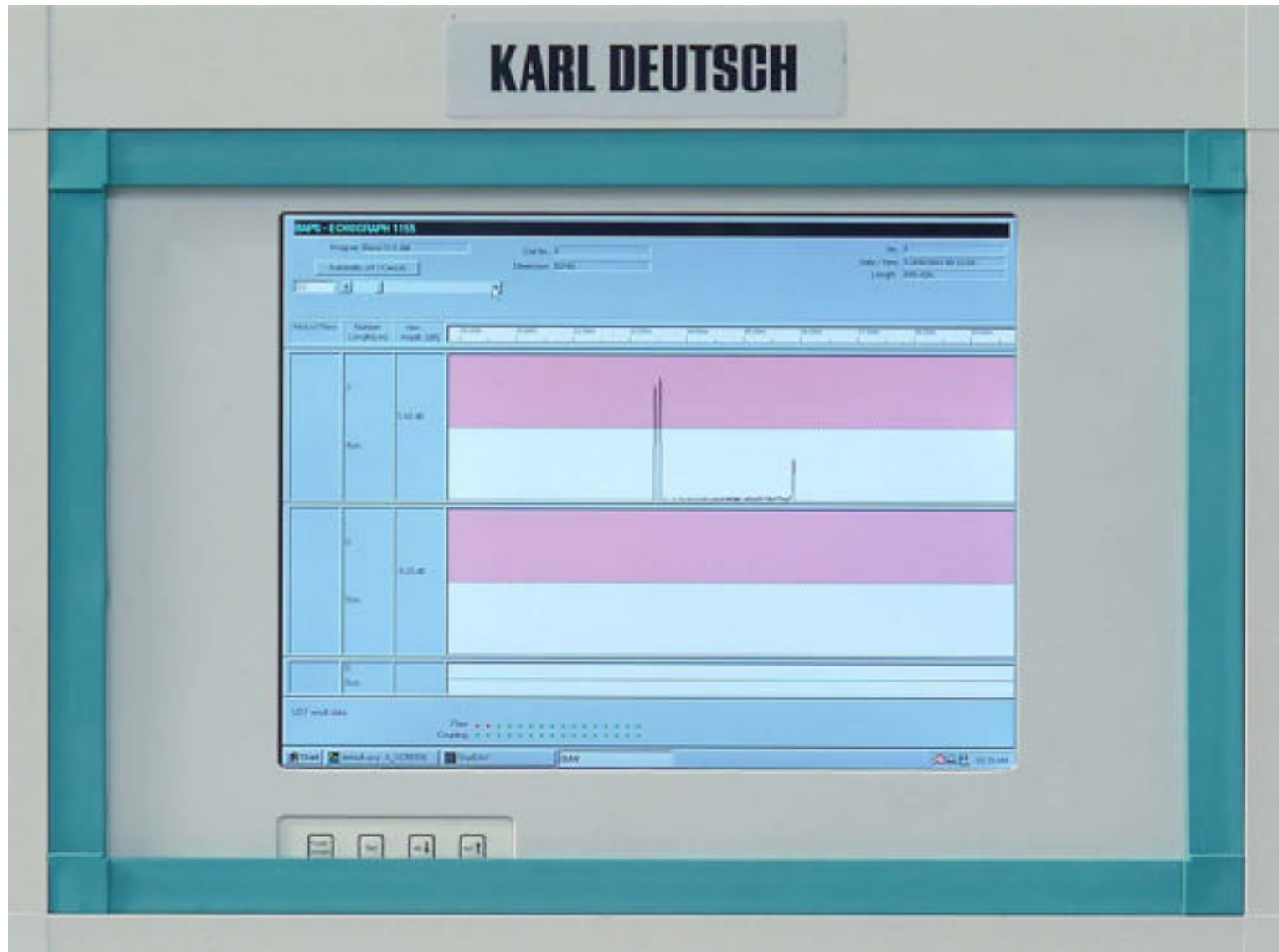
KARL DEUTSCH



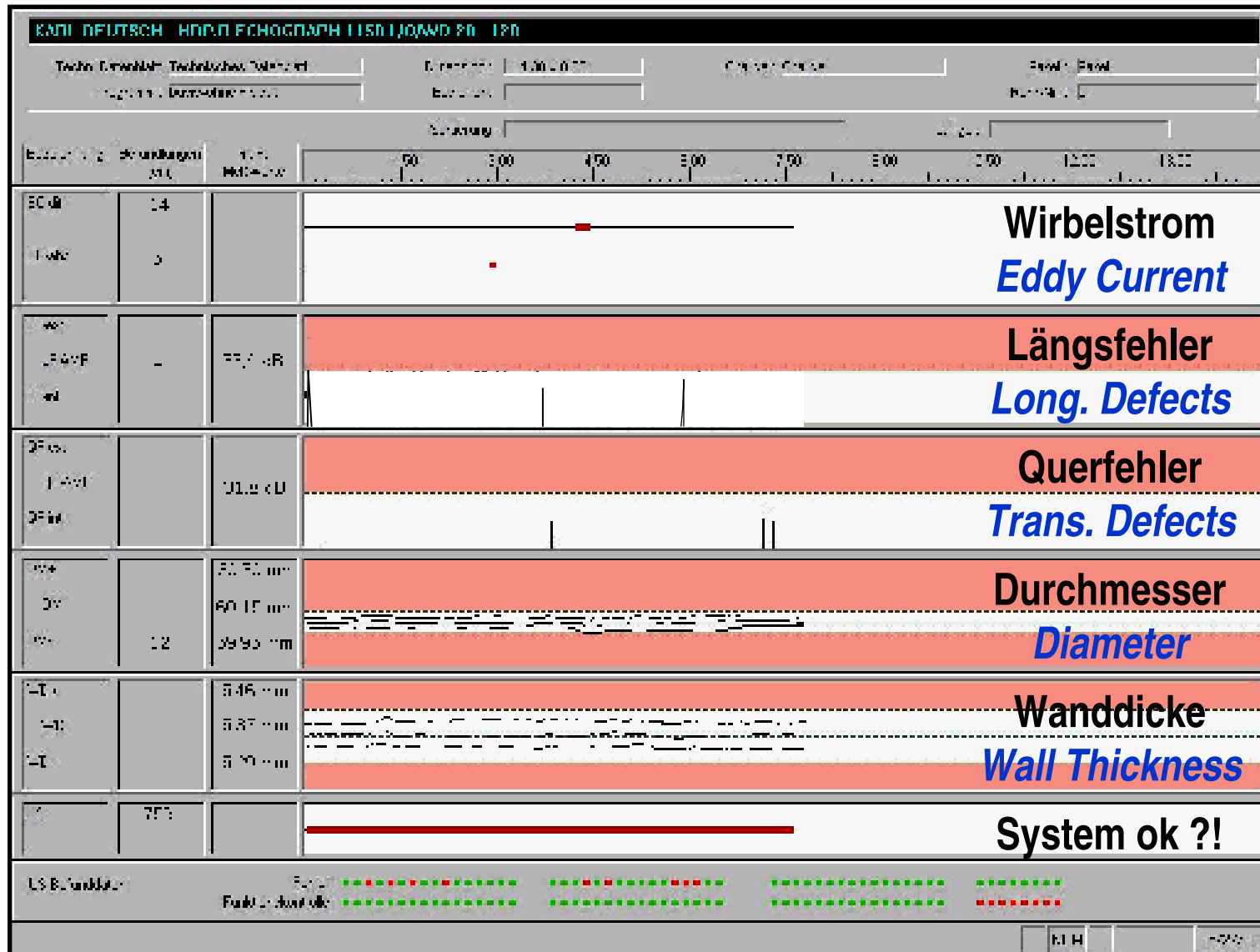
ECHOGRAF 1155 Bedien-Anzeige-Gerät (BAG)



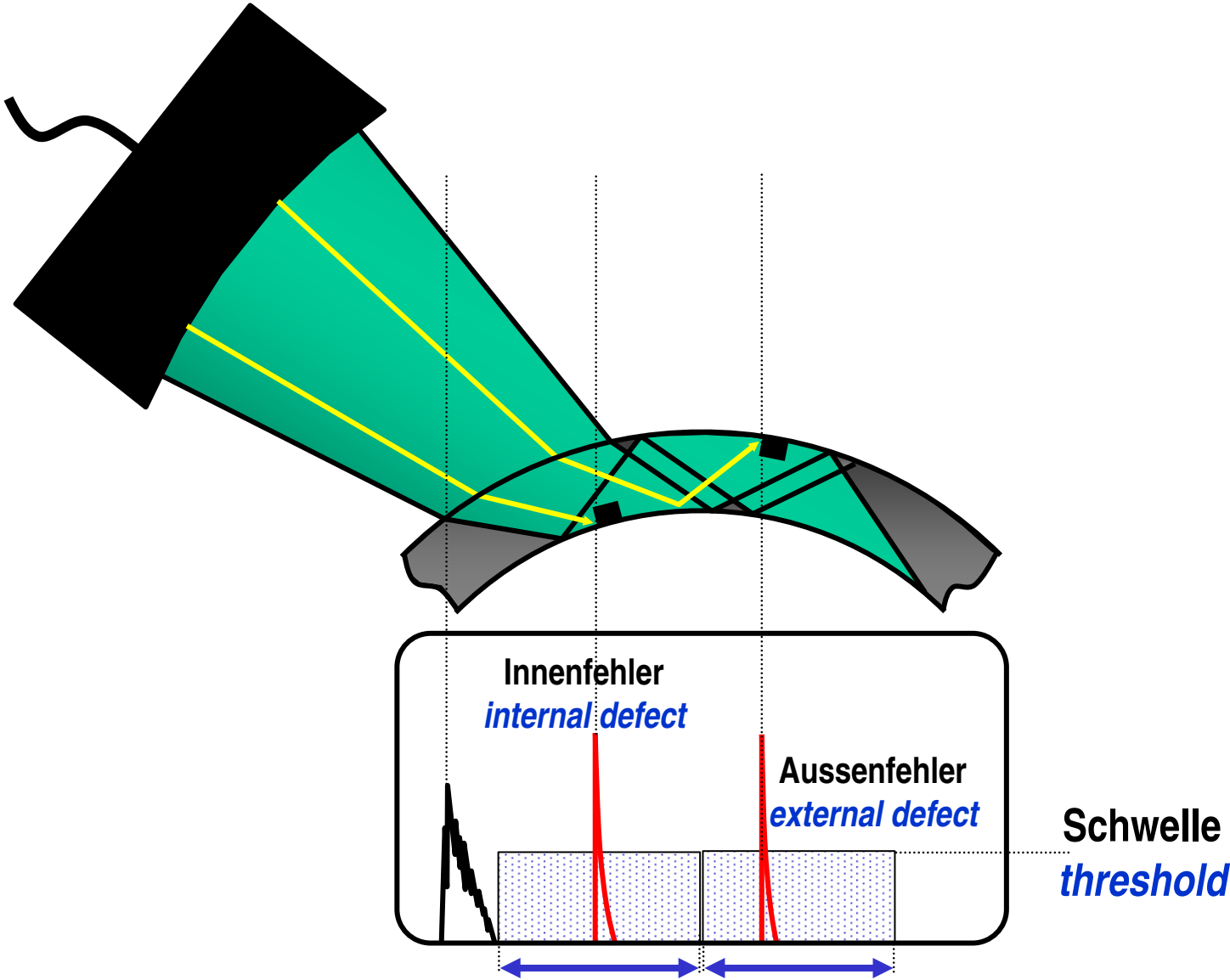
ECHOGRAPH 1155 Windows-Bedienung



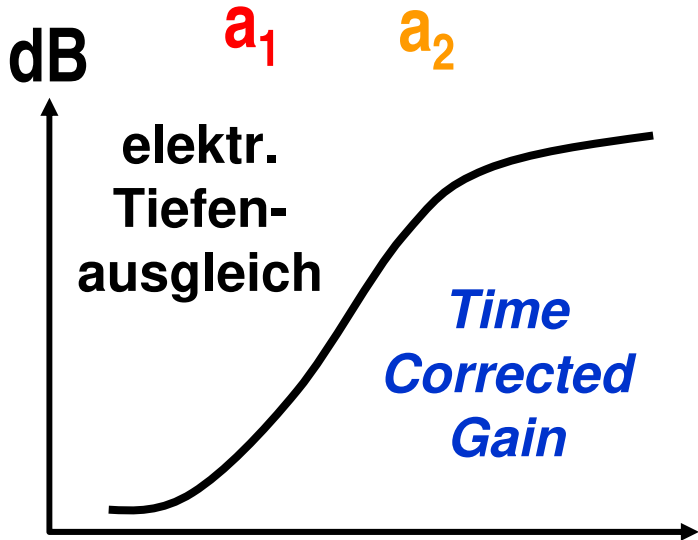
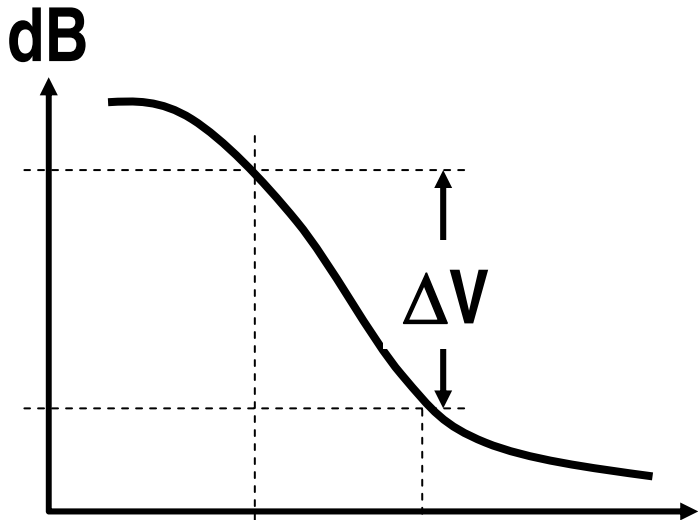
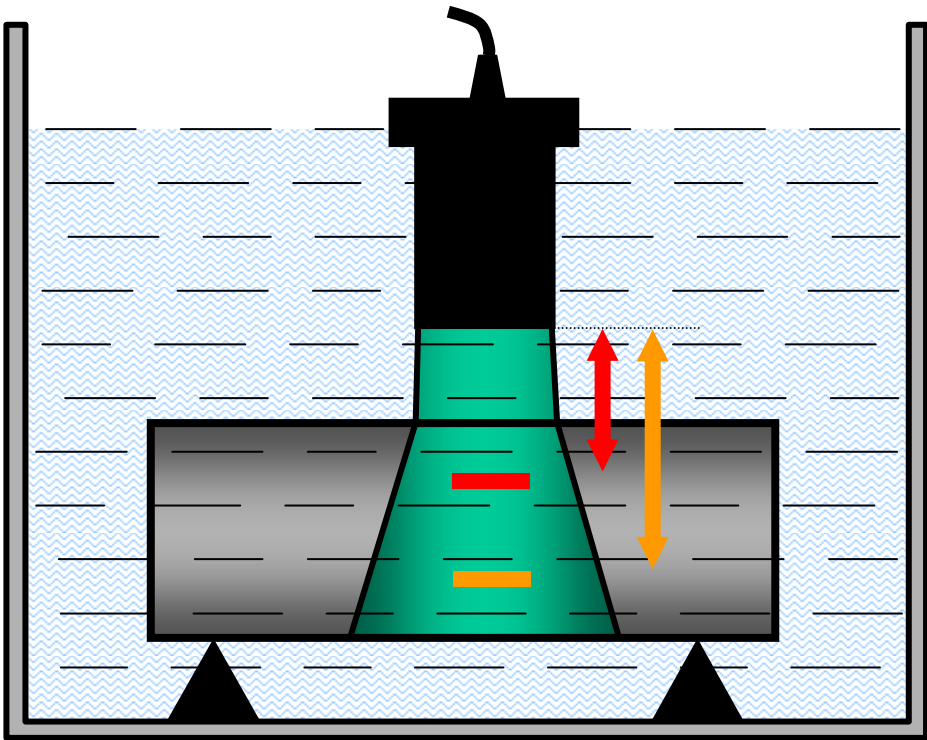
ECHOGRAPH 1155 Online-Amplituden-Darstellung



On-Line Prüfmaske (Rohr) *On-Line Test Report (Tube)*



Prinzip (Rohre) *Principle (Tubes)*



Digitaler Tiefenausgleich *Time-Corrected Gain (TCG)*

The screenshot displays the DAV (Datenverwaltungssystem) interface. At the top, there are user selection buttons for 'USER 1' through 'USER 4' and 'DAV' through 'STE', all labeled 'EINGELOGGT'. Below this is a navigation bar with options like 'Hilfen', 'Auftragsdaten', 'Anzeige', 'Drucken', 'Einstellungen', 'Terminale', and 'Service'. The main area shows a 'Auftragsdaten' dialog box with the following fields:

- Auftragsnummer: [Dropdown menu]
- Auftragsnummer spezifizieren: [Text input]
- Speichern: [Button]
- Technische Daten:
 - Abrechnungswahl: [Text input]
 - Art: [Text input]
 - Extrakt: [Text input] | [Text input] | [Text input]
 - Produkt: [Text input]
 - Gruppe: [Text input]
 - Typ: [Text input]
- Herstellernummer: [Text input]
- Produkttyp: [Text input]
- OK: [Button]
- Abbrechen: [Button]

Maske zur
Eingabe der
Auftragsdaten

screen for
entering of
batch data

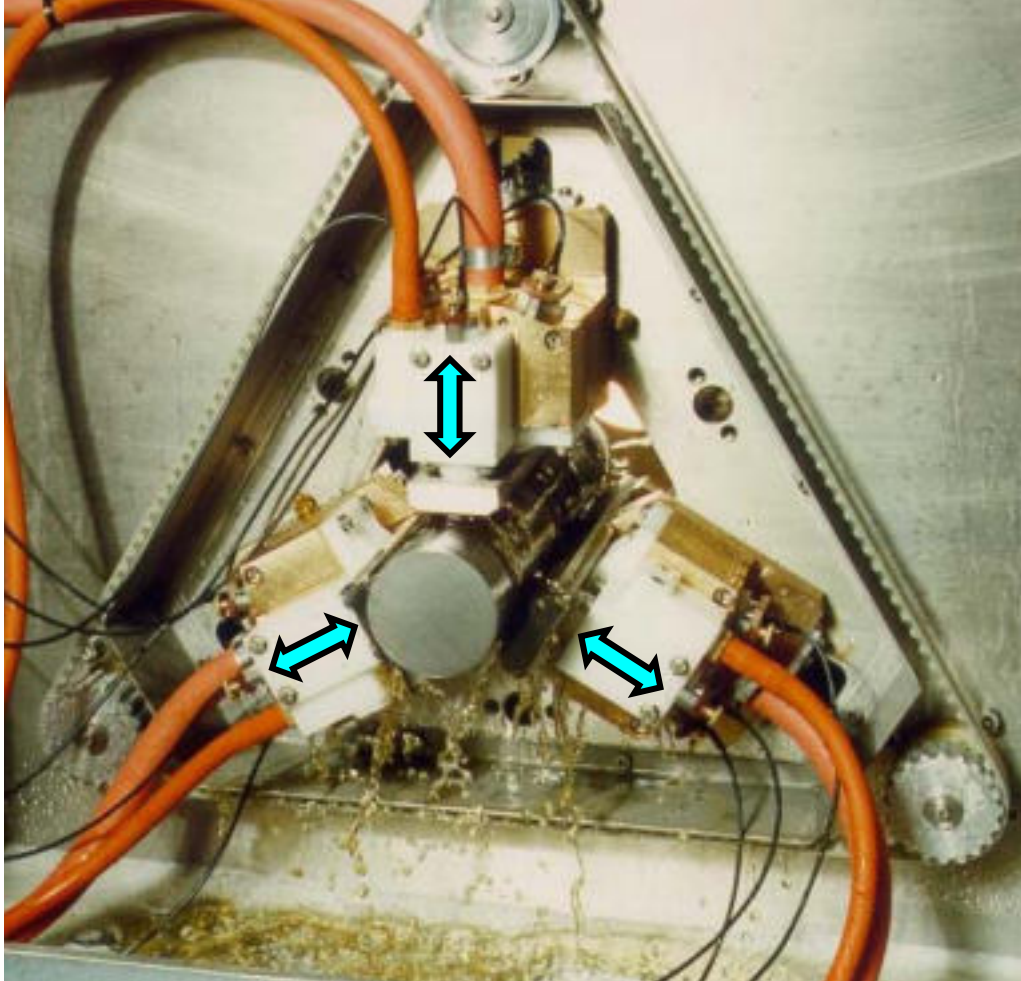
DAV: Datenverwaltungssystem *data management system*

KARL DEUTSCH

ECHOGRAPH

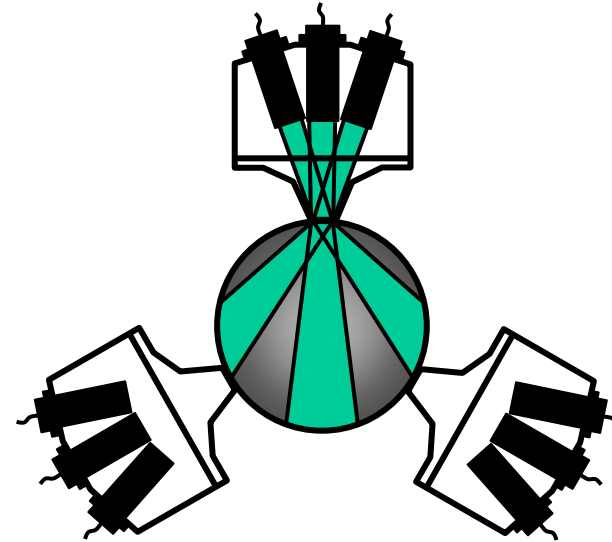
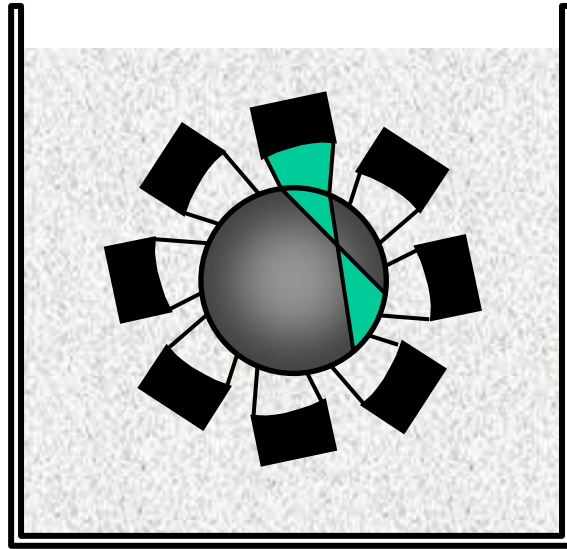
**Beispiele KARL DEUTSCH
Ultraschall-Prüfanlagen**

**Examples KARL DEUTSCH
*Ultrasonic Testing Systems***

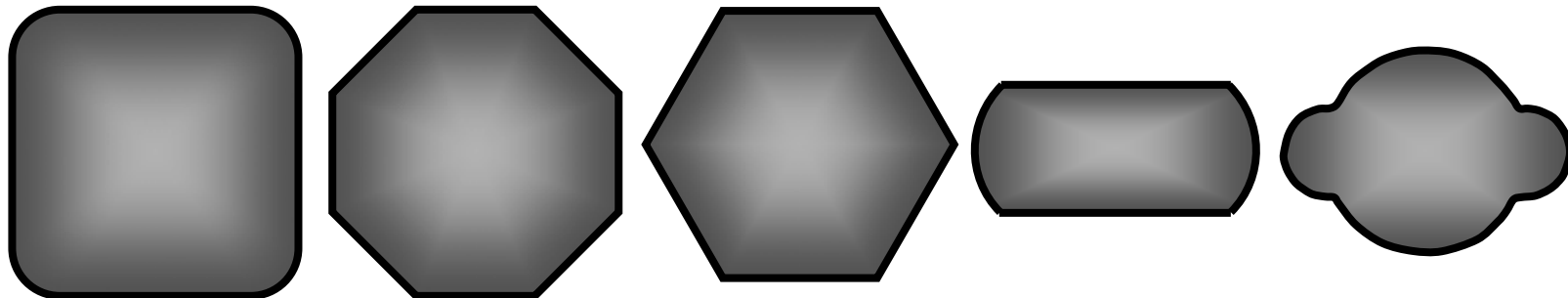


STPS Stangen-Prüfsystem *STPS Bar Inspection*

Ankopplung *Coupling*

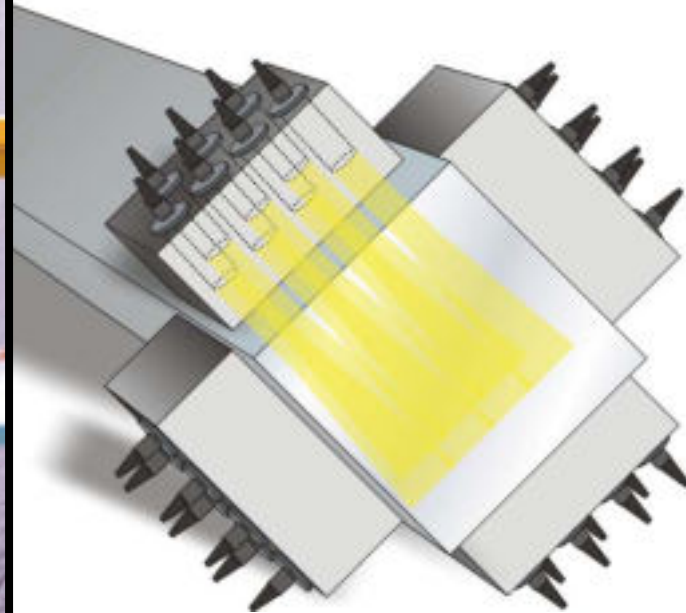
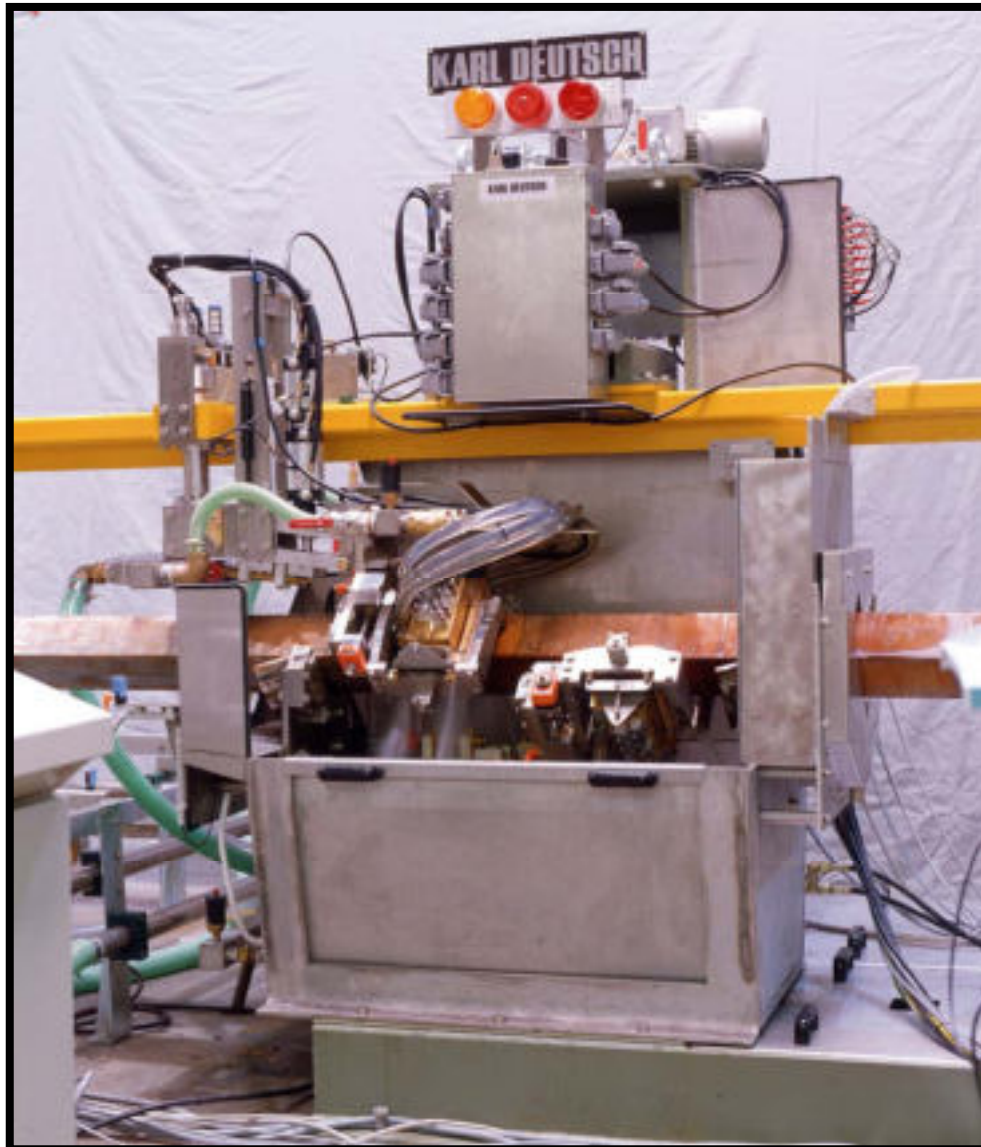


Profile *Profiles*



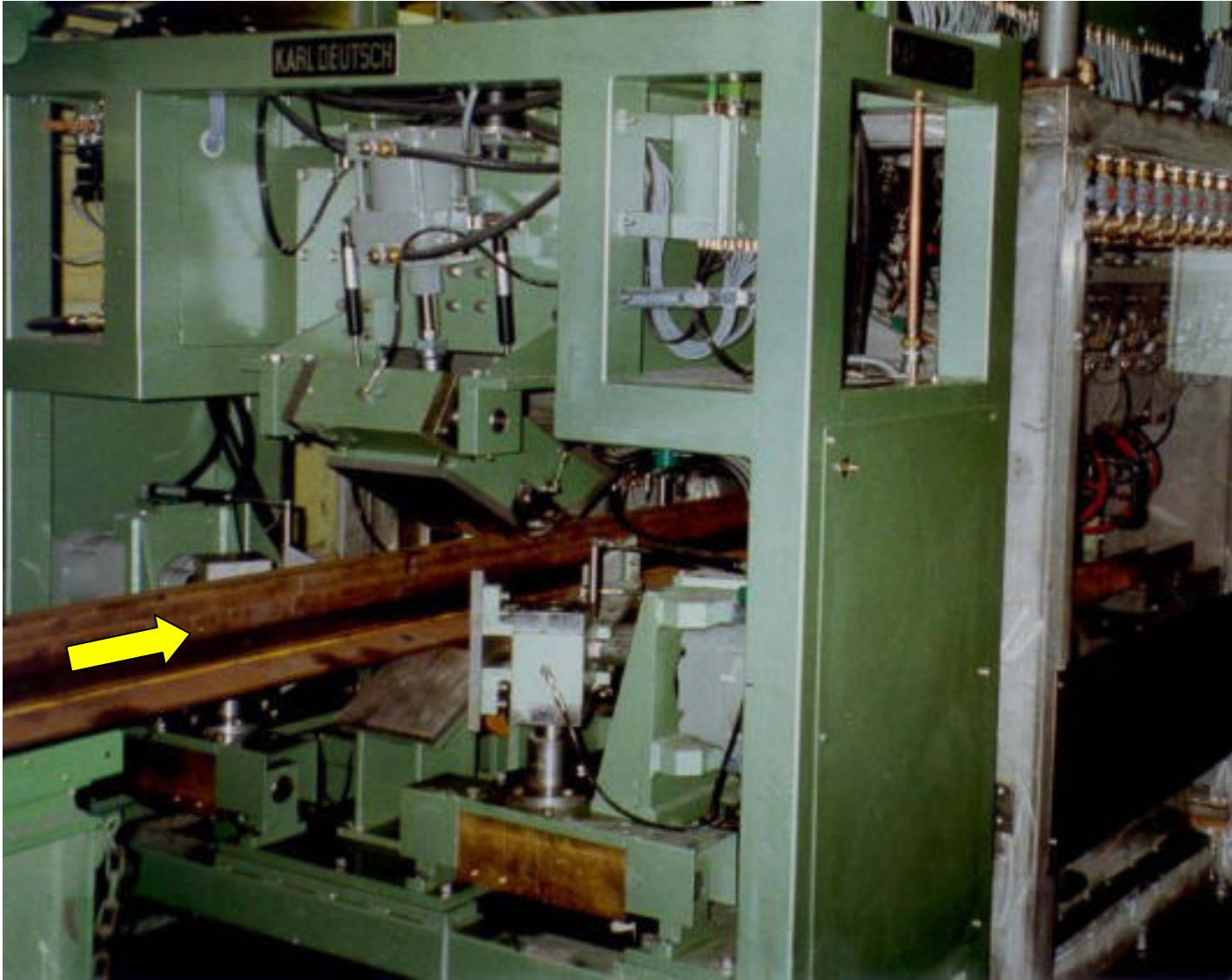
Varianten Stangenprüfung *Possibilities Bar Inspection*

KARL DEUTSCH



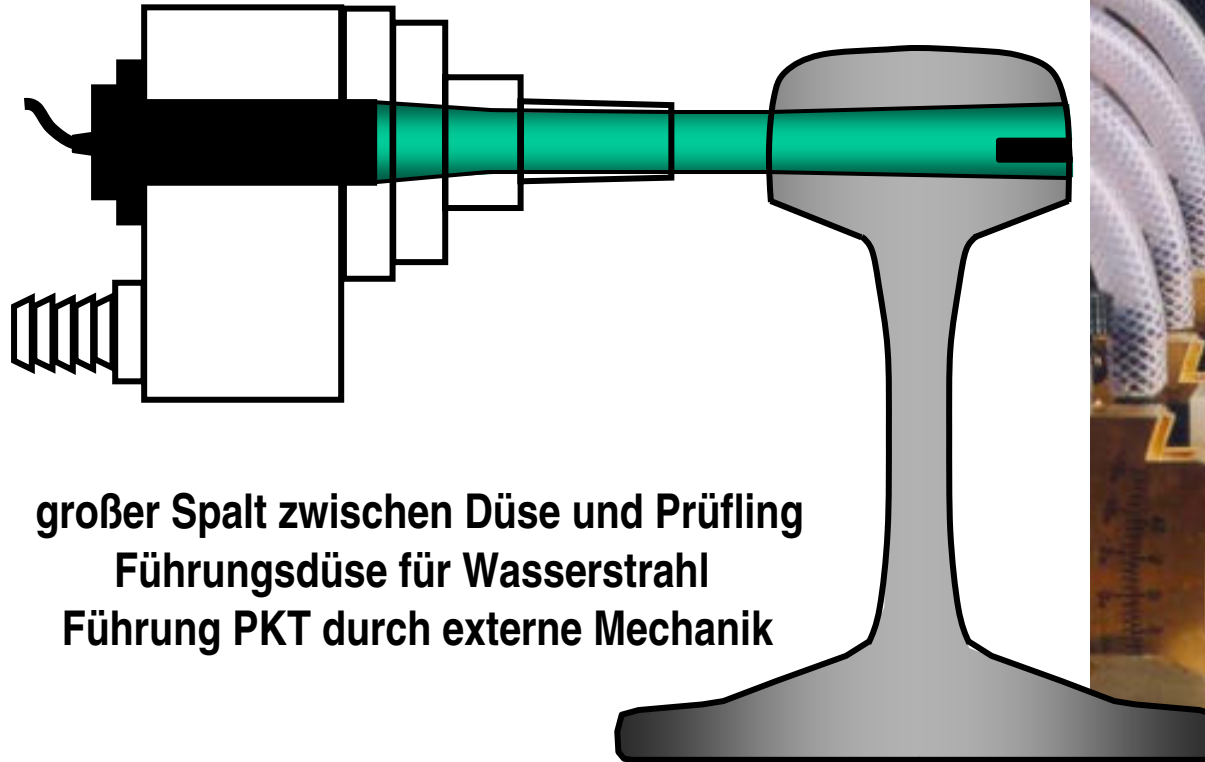
KNPS Knüppel-Prüfsystem *KNPS Billet Inspection*

KARL DEUTSCH



SCHN Schienenprüfung *SCHN Rail Inspection*

(SNUL-SNUS Overview for PC Feb02, p. 83)



großer Spalt zwischen Düse und Prüfling
Führungsdüse für Wasserstrahl
Führung PKT durch externe Mechanik

*large gap between nozzle & specimen
nozzle for water jet guidance
guidance of probe carrier
with external mechanics*



Freie Wasserstrahlen *Free Water Jets*

KARL DEUTSCH



STFL Stahlflaschen-Prüfung *STFL Inspection of Gas Cylinders*

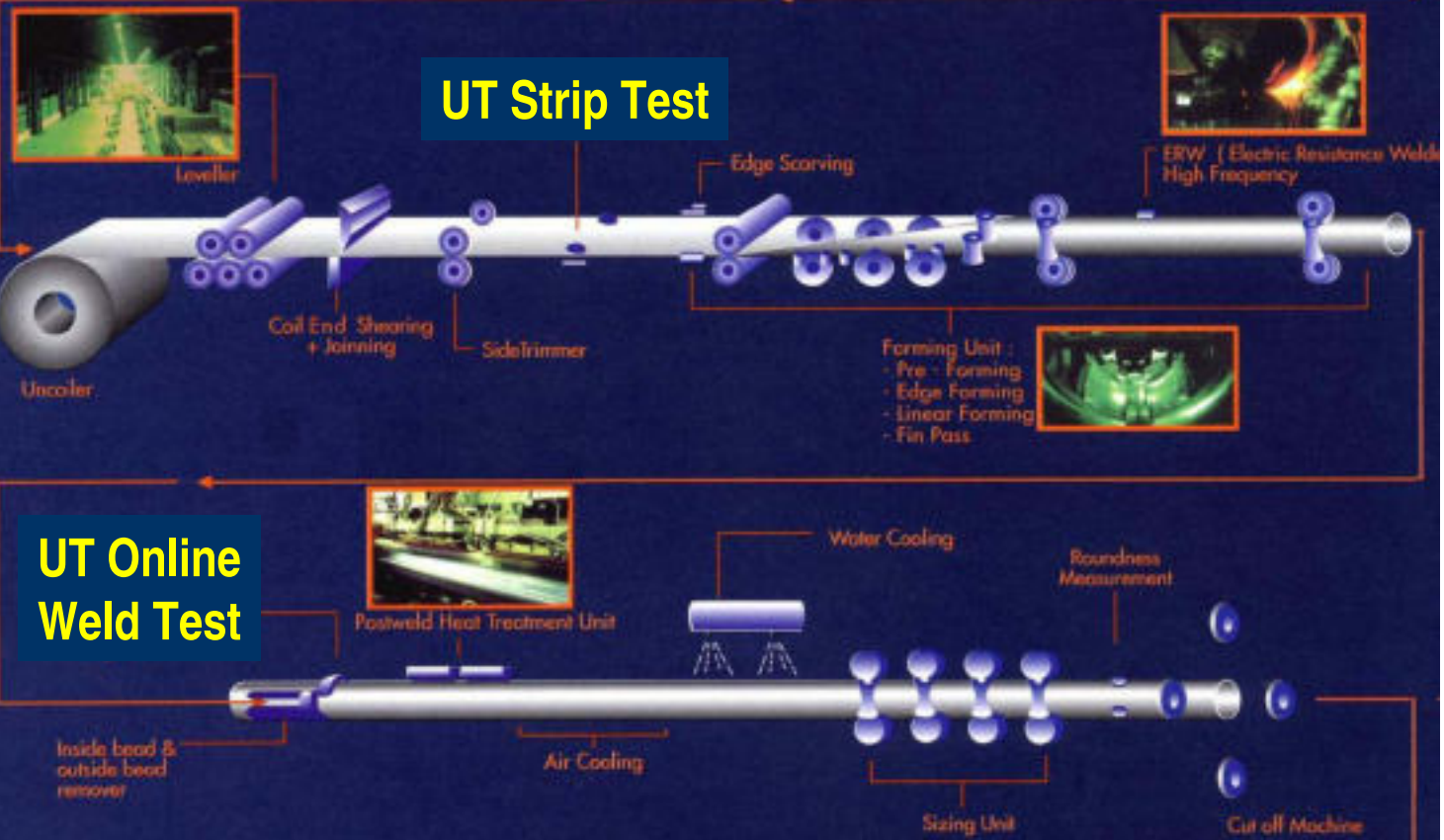
KARL DEUTSCH

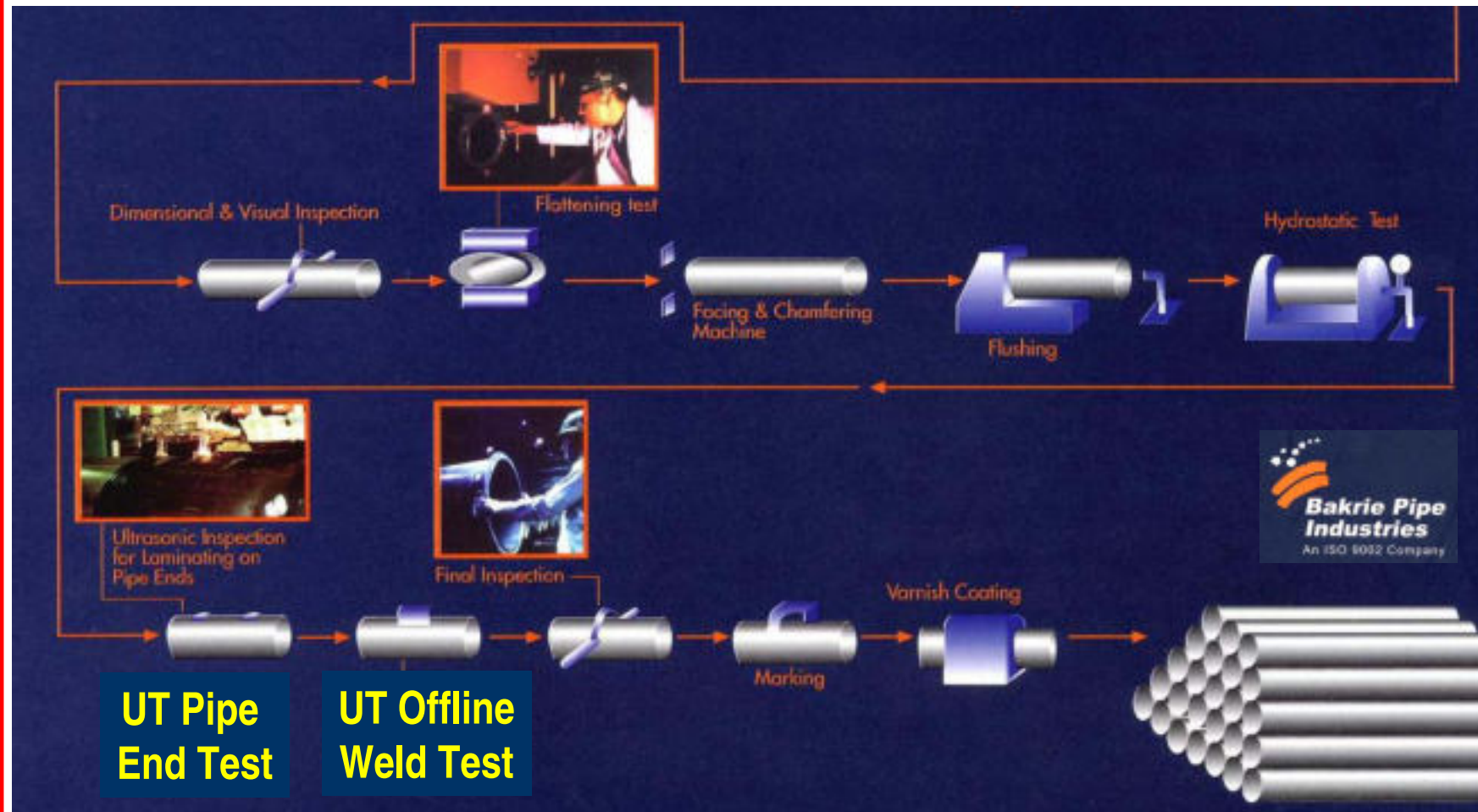
ECHOGRAPH

Prüfung HF-Rohre

ERW-Pipe Test

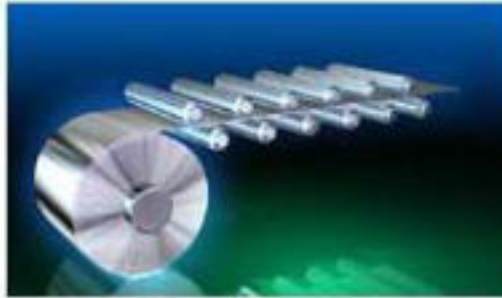
NDT During Production Process (I)





NDT During Production Process (Part II) @ Bakrie Pipe Indonesia

KARL DEUTSCH



Strip unwinding and leveling



Side edges cutting

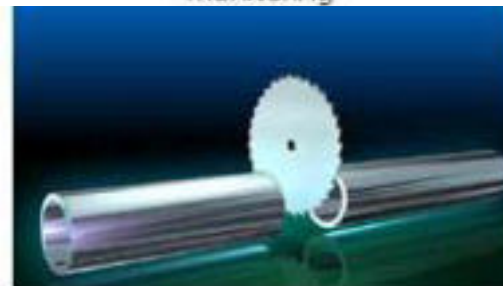


Tube body forming

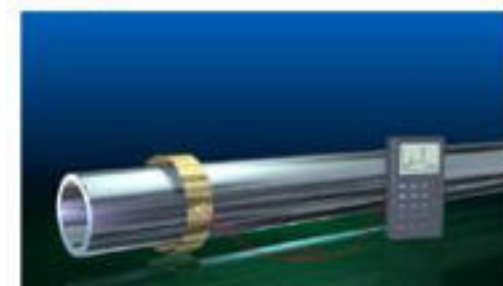


RF current welding, welding modes monitoring

*Inspection
on the strip
with BAPS-ECHOGRAPH
or
on the welded pipe
with RPT.R-ECHOGRAPH*



Pipe cutting with flying shears



Ultrasonic seam testing

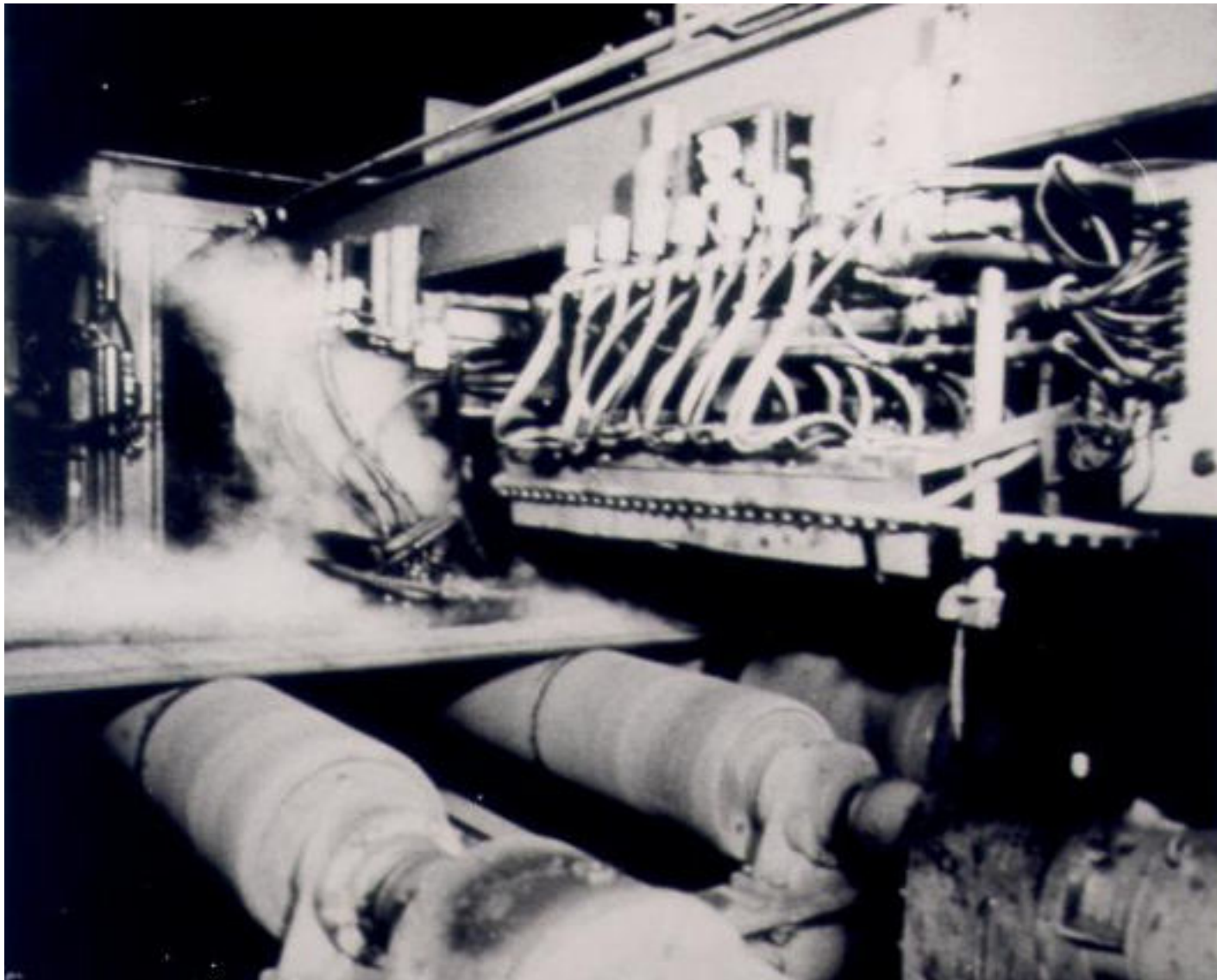
2 Positionen zur Rohrkörper-Prüfung **2 Positions for Full-Body Test**

KARL DEUTSCH

BAPS-Echograph

Band-Prüfung

Strip Test



Bandprüfung *Strip Inspection* (Hösch, 1970)



BAPS Band-Prüfsystem *BAPS Strip Inspection (16 probes)*

KARL DEUTSCH



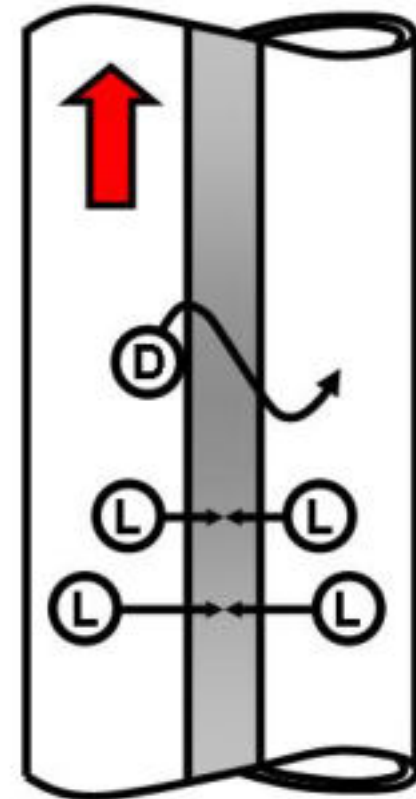
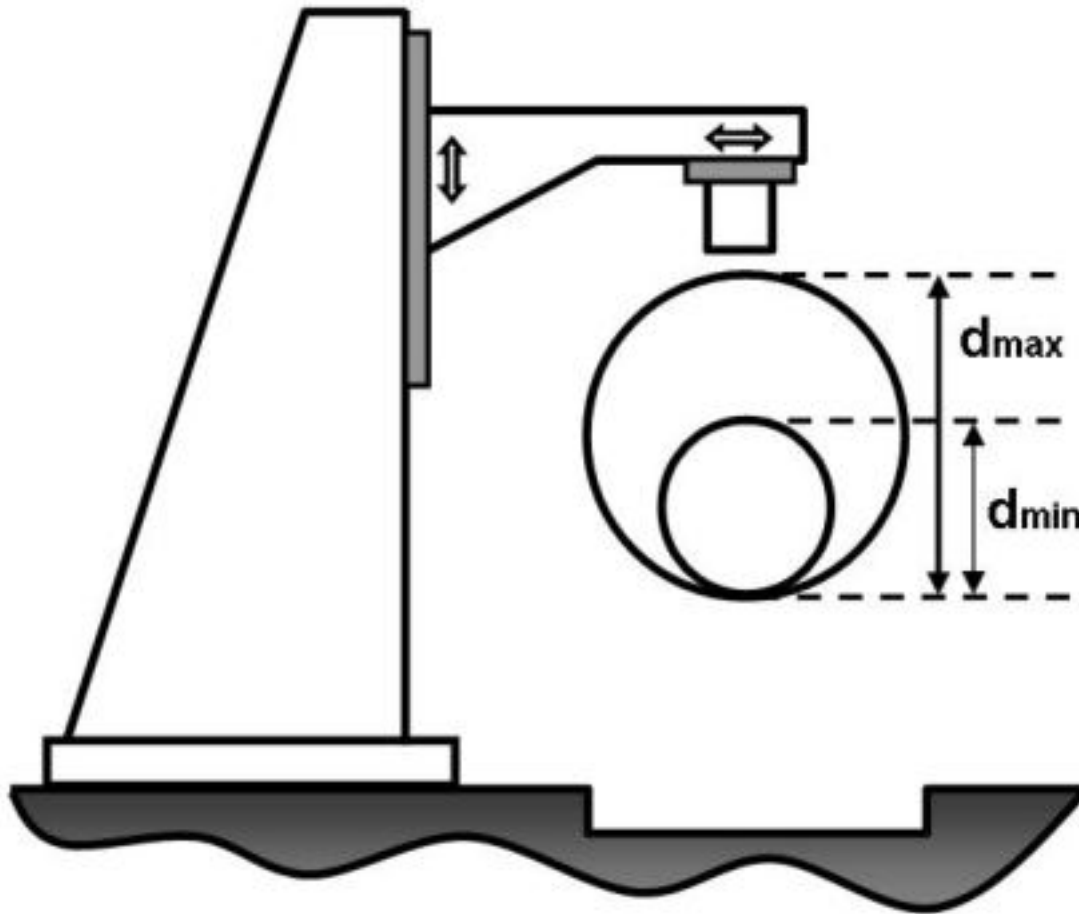
BAPS-Echograph1155 (37 probes) @ Baosteel China 2005

KARL DEUTSCH

SNHF-Echograph

Online Schweißnaht-Prüfung

Online ERW Weld Test



SNHF in-line Prüfung *SNHF on-line test*



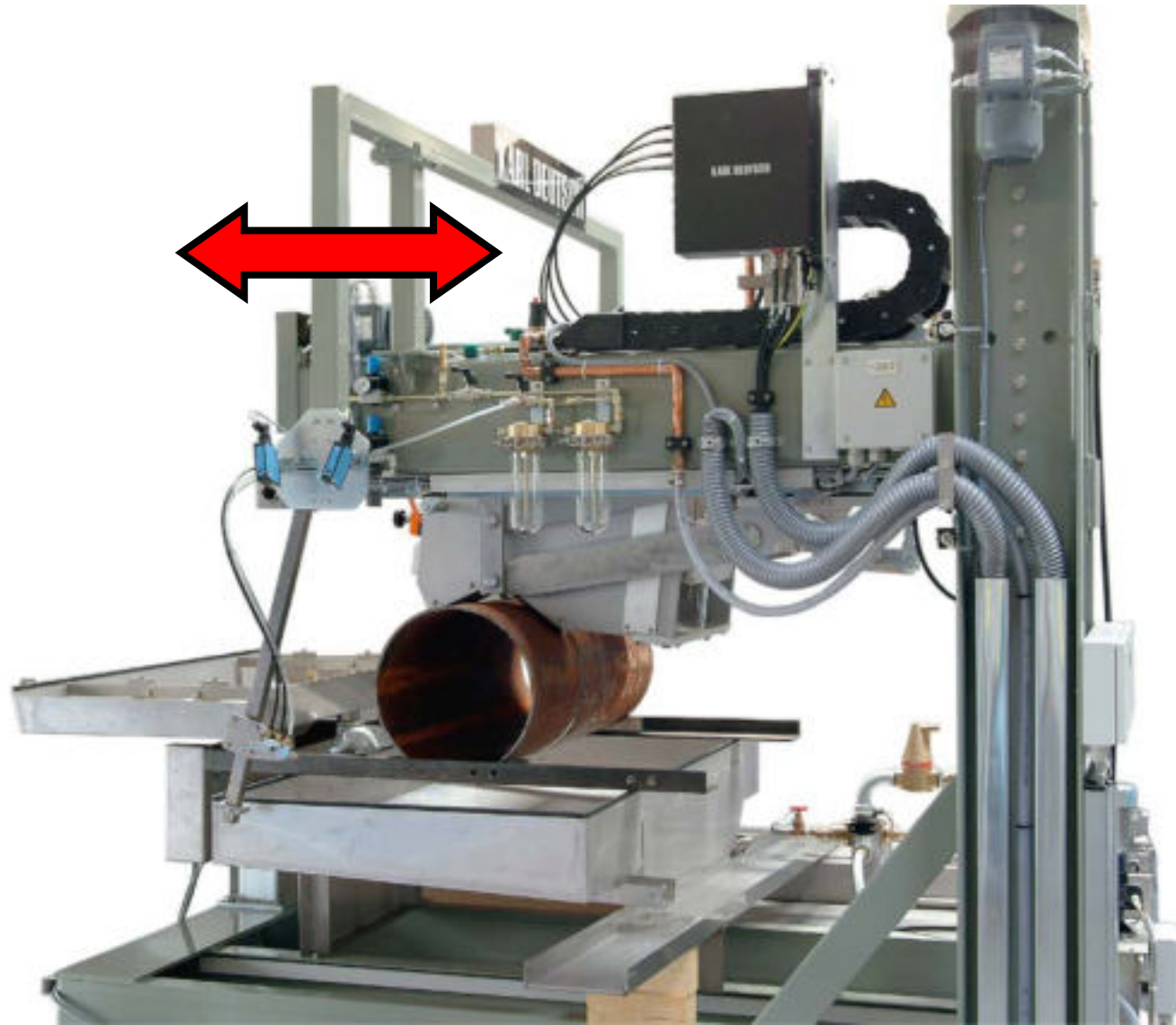
Technische Daten:

- Rohr \varnothing = 219 - 508 mm
- 2 Prüfköpfe, LF außen
- 2 Prüfköpfe LF innen
- Kalibrier-Station
- Prüfung direkt hinter Schweißmaschine
- Testfehler 1.6mm Bohrung

Prüfköpfe:

- Tauchtechnik-Prüfköpfe (Strahlankopplung)
- 10 mm Wandler
- 4 MHz
- Composite

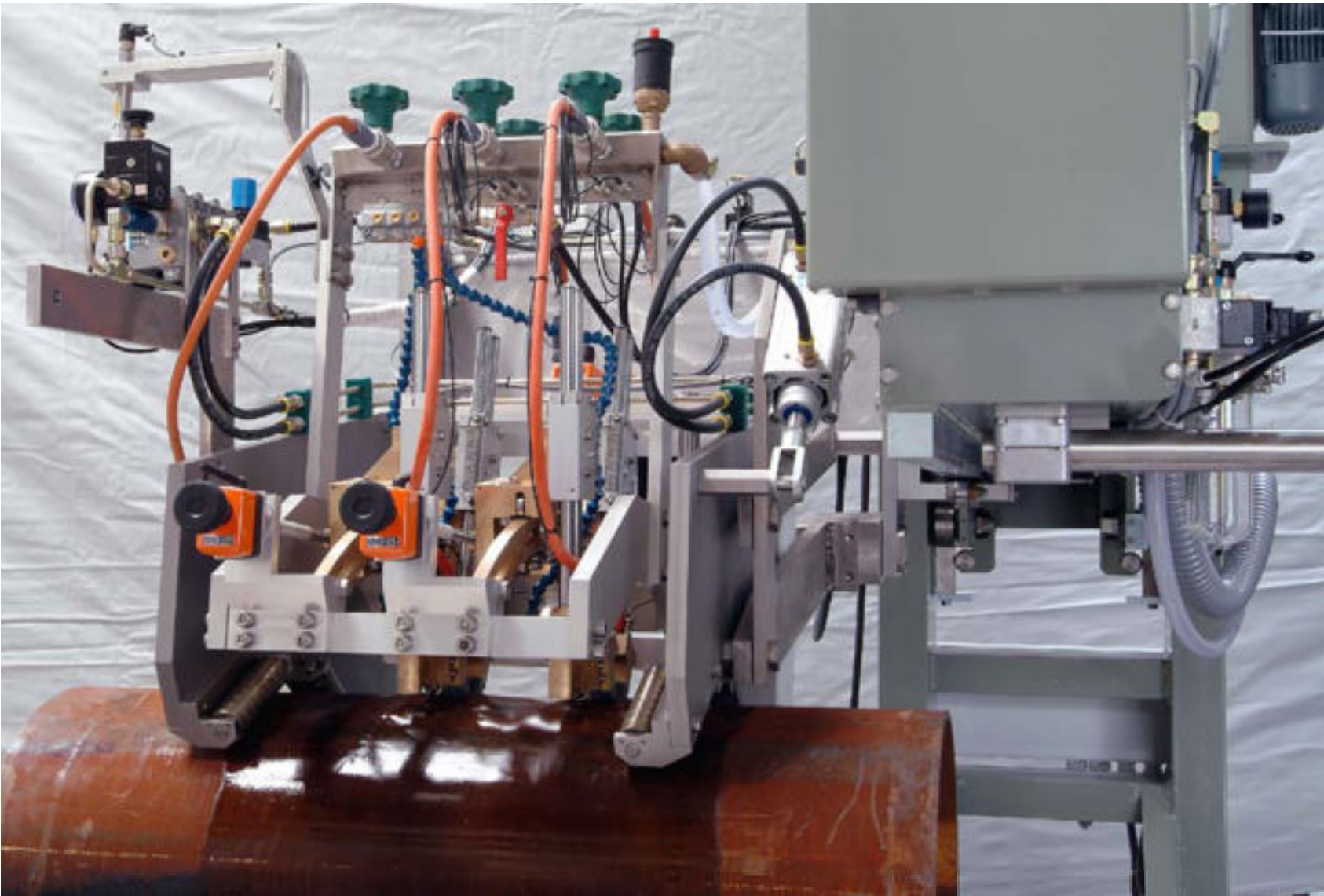
SNHF HF-Schweißnaht-Prüfung *SNHF ERW-Weld Test*



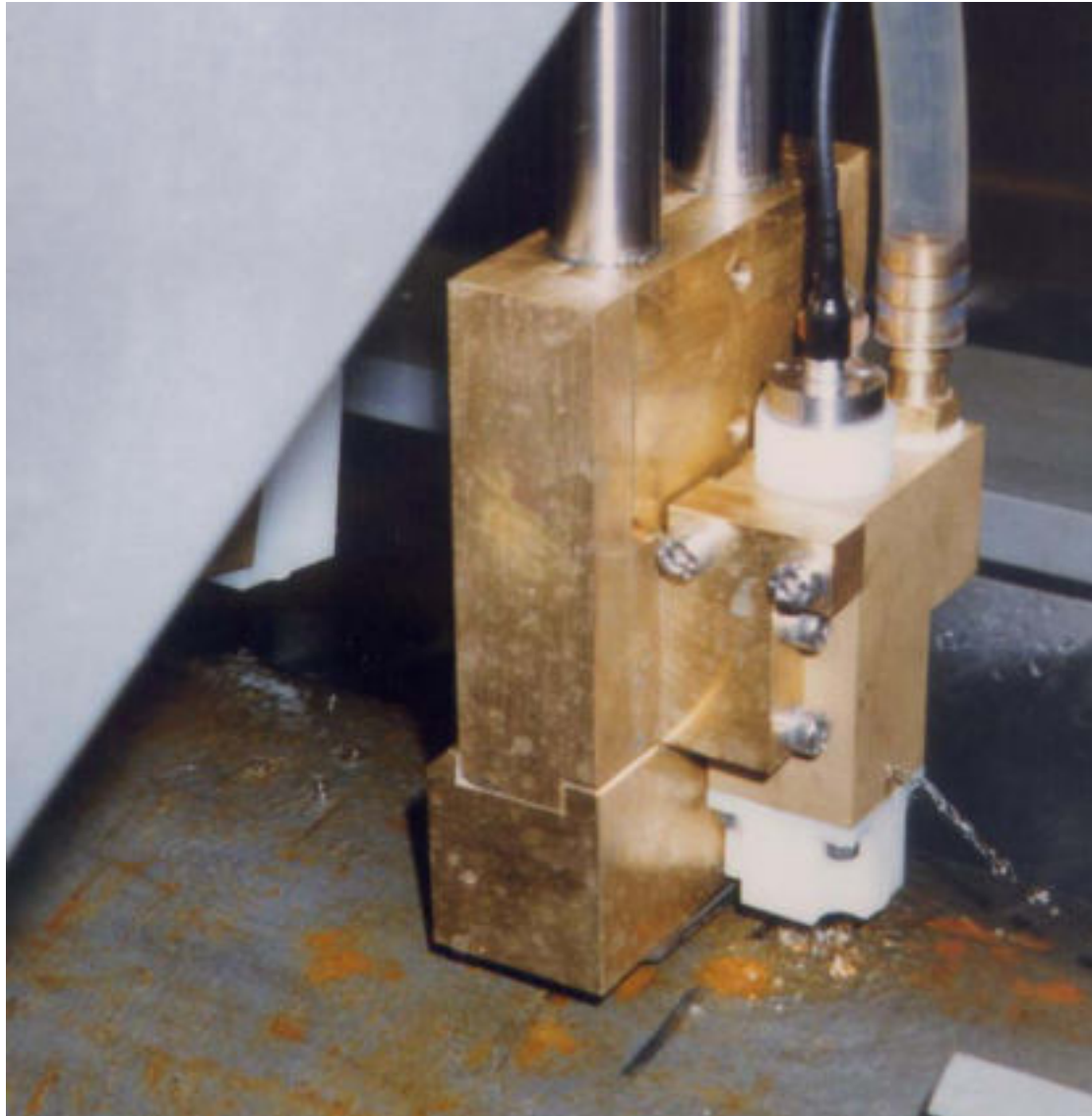
Mechanik in Prüfposition *Mechanics in Test Position*



SNHF motorisierte Kalibrier-Station *SNHF Motorized Calibration Stand*



SNHF Prüfkopfträger *SNHF Probe Holders*



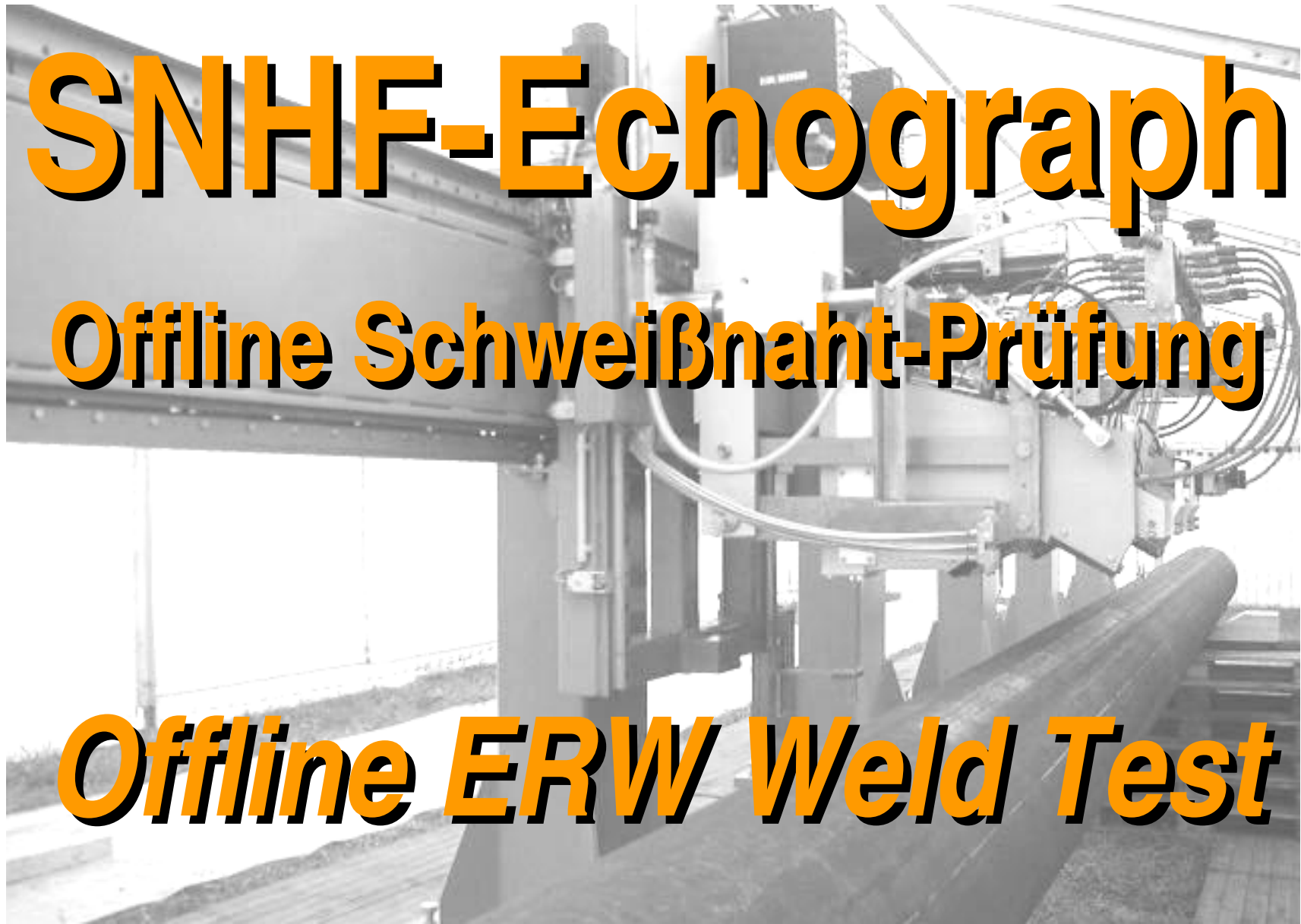
SNHF Schabungskontrolle *SNHF deburring check*

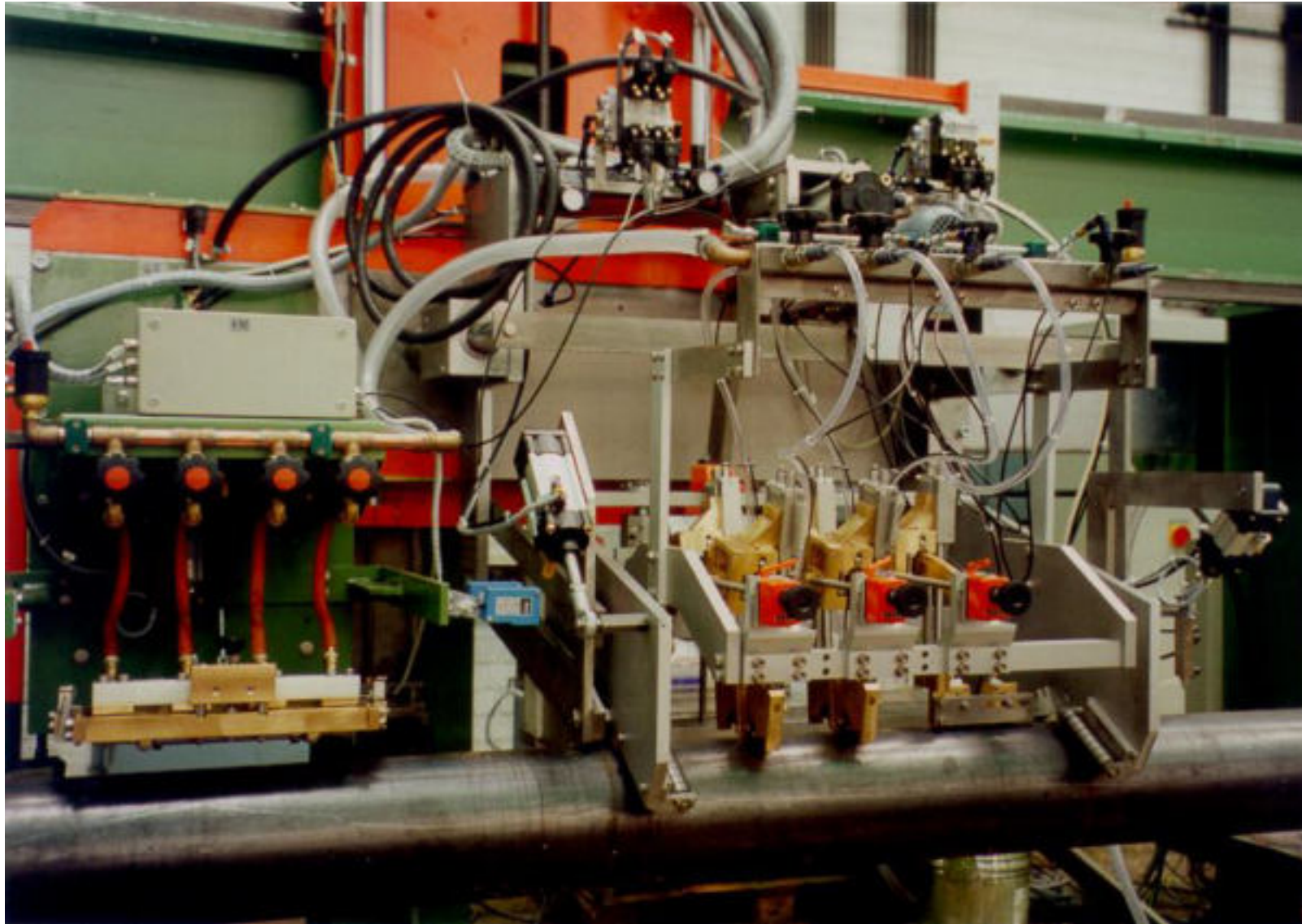
KARL DEUTSCH

SNHF-Echograph

Offline Schweißnaht-Prüfung

Offline ERW Weld Test





SNHF off-line Prüfung *SNHF off-line test*

Technische Daten:

- Rohrlänge maximal 12,4 m
- 2 Prüfköpfe, LF außen
- 2 Prüfköpfe LF innen
- 2 Prüfköpfe Querfehler
- 4 Prüfköpfe Dopplungen
- 2 Prüfköpfe Rohrende
- **Summe 12 Prüfköpfe**
- Kalibrier-Station
- Prüfung nach Expander & Druckprüfung
- **ca. 60 Rohre / Stunde**

Prüfköpfe Schweißnaht:

- Tauchtechnik-Prüfköpfe (Strahlankopplung)
- 10 mm Wandler
- 4 MHz, Composite

PK Dopplungen/Rohrende:

- SE-PK (Spaltankopplung)
- 4 MHz



Technical Data:

- *maximum tube length 12,4 m*
- *2 probes, L-defect ext.*
- *2 probes, L-defect int.*
 - *2 probes T-defect*
- *4 probes laminations*
 - *2 probes tube end*
- ***total of 12 probes***
 - *calibration stand*
- *test after expander & pressure test*
- ***approx. 60 tubes / hour***

Probes for Weld:

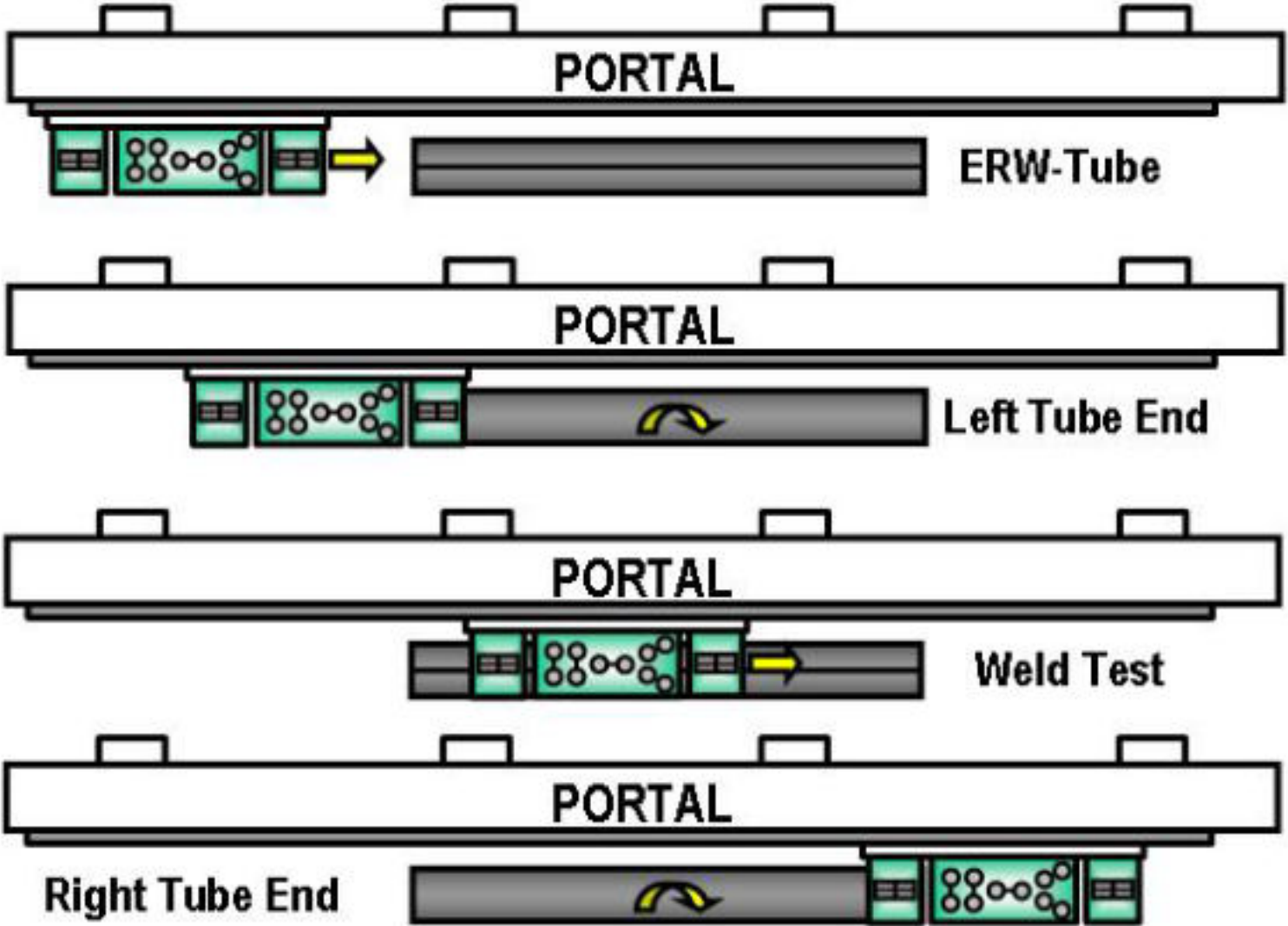
- *immersion probes (jet coupling)*
 - *10 mm crystal*

- *4 MHz, piezo-composite*

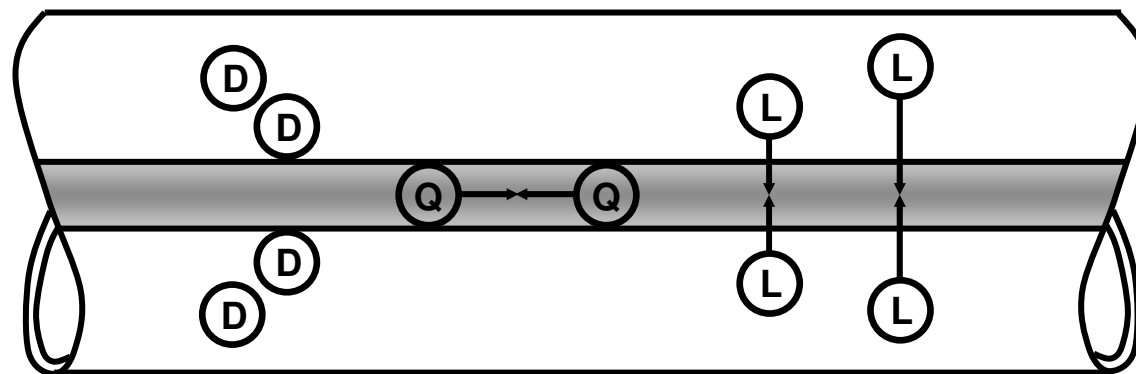
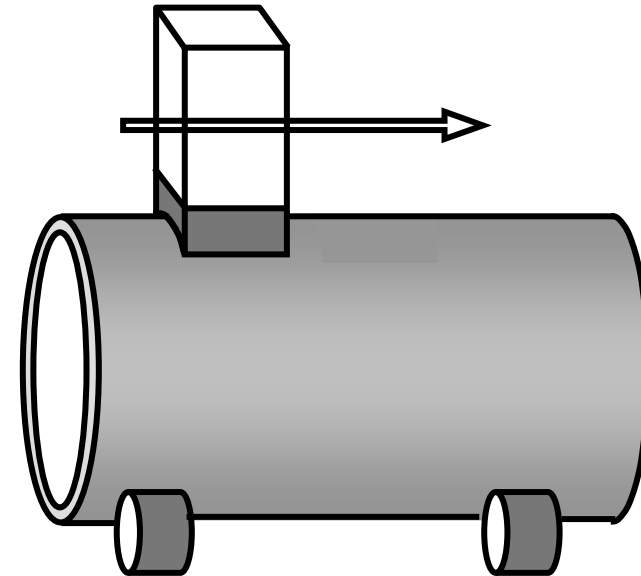
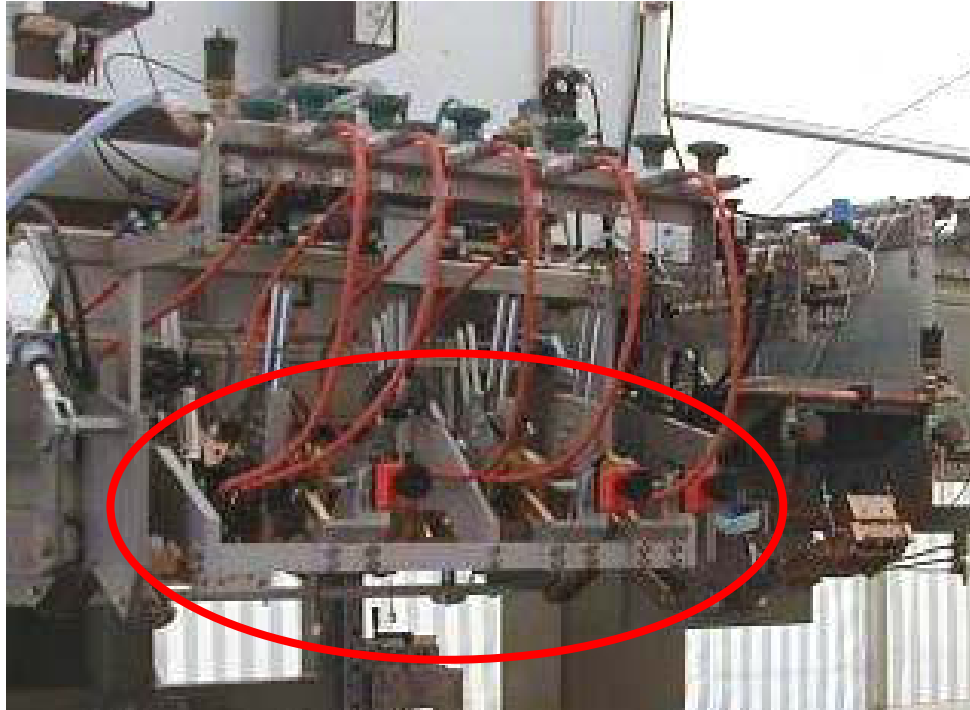
Probes Laminations / Ends:

- *dual element (gap coupling)*
 - *4 MHz*

SNHF-offline (Prüftraverse) SNHF-offline (Test Portal)

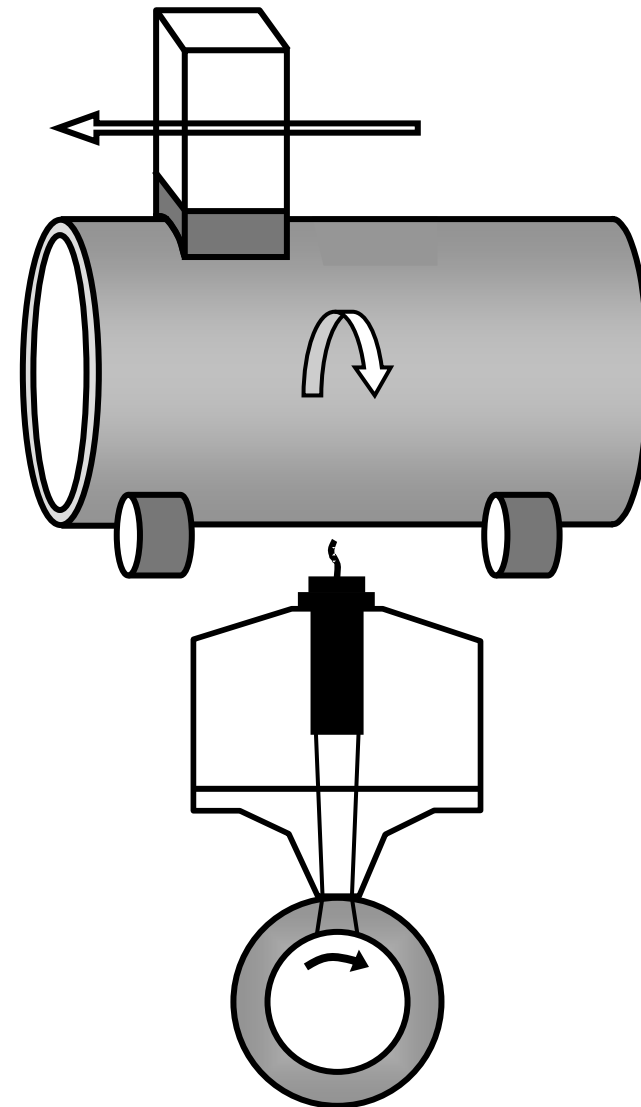
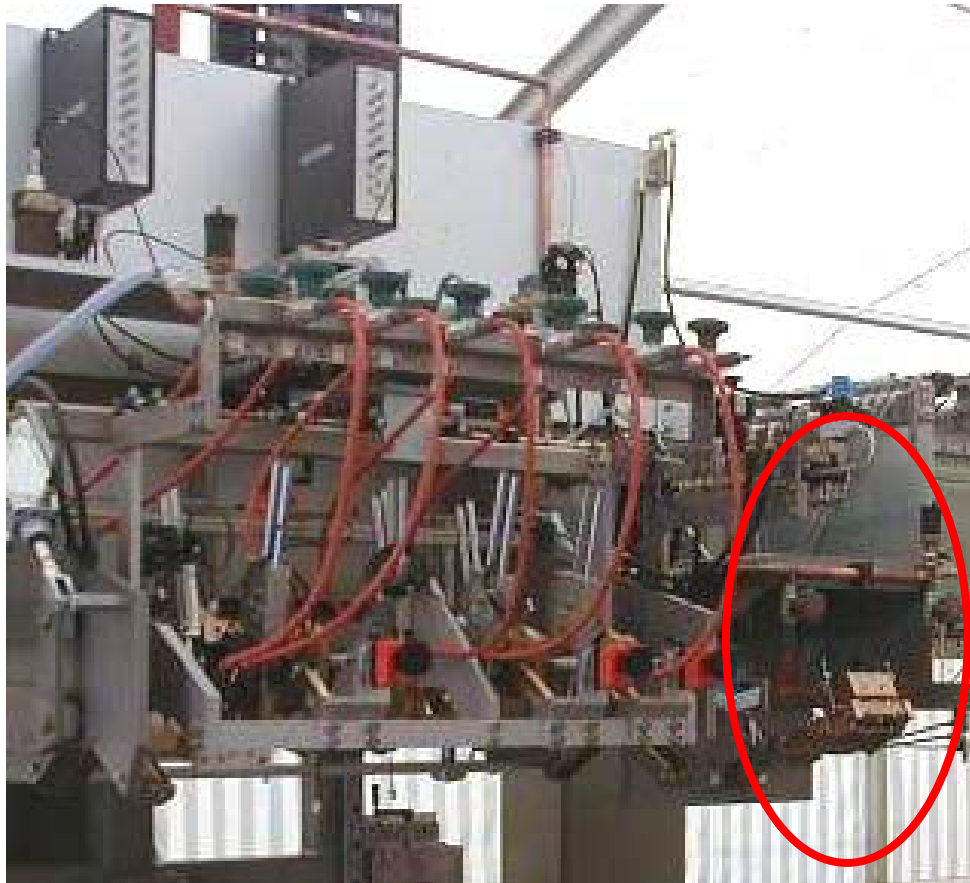


SNHF-offline (Prüftraverse) SNHF-offline (Test Portal)

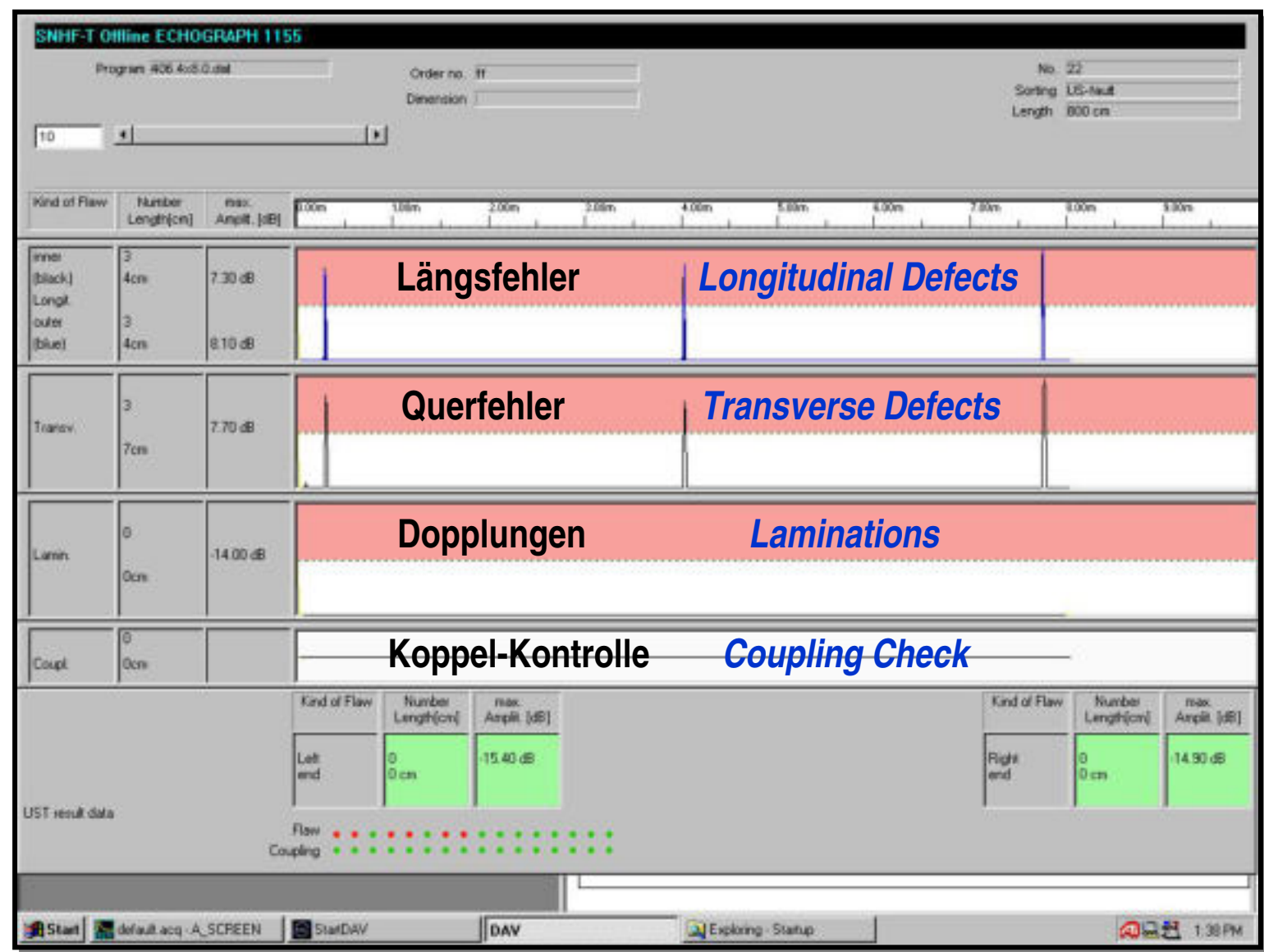


Schweißnaht-Prüfung (4L 2Q 4DP) *Weld Inspection*

Spaltankopplung
2 Kanäle, 50 mm Prüfspur

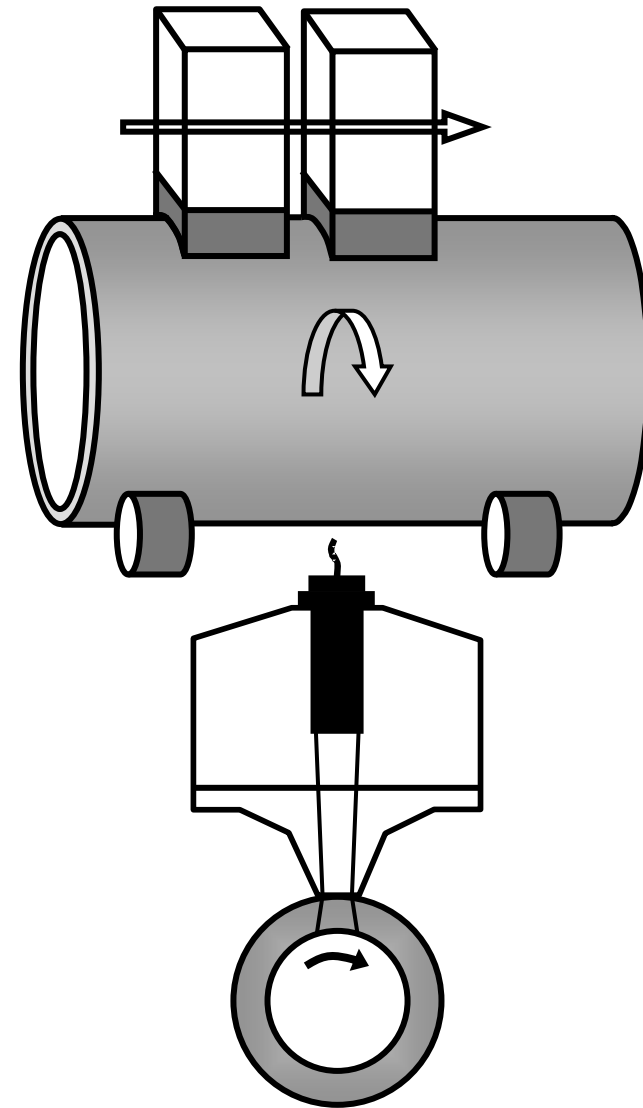
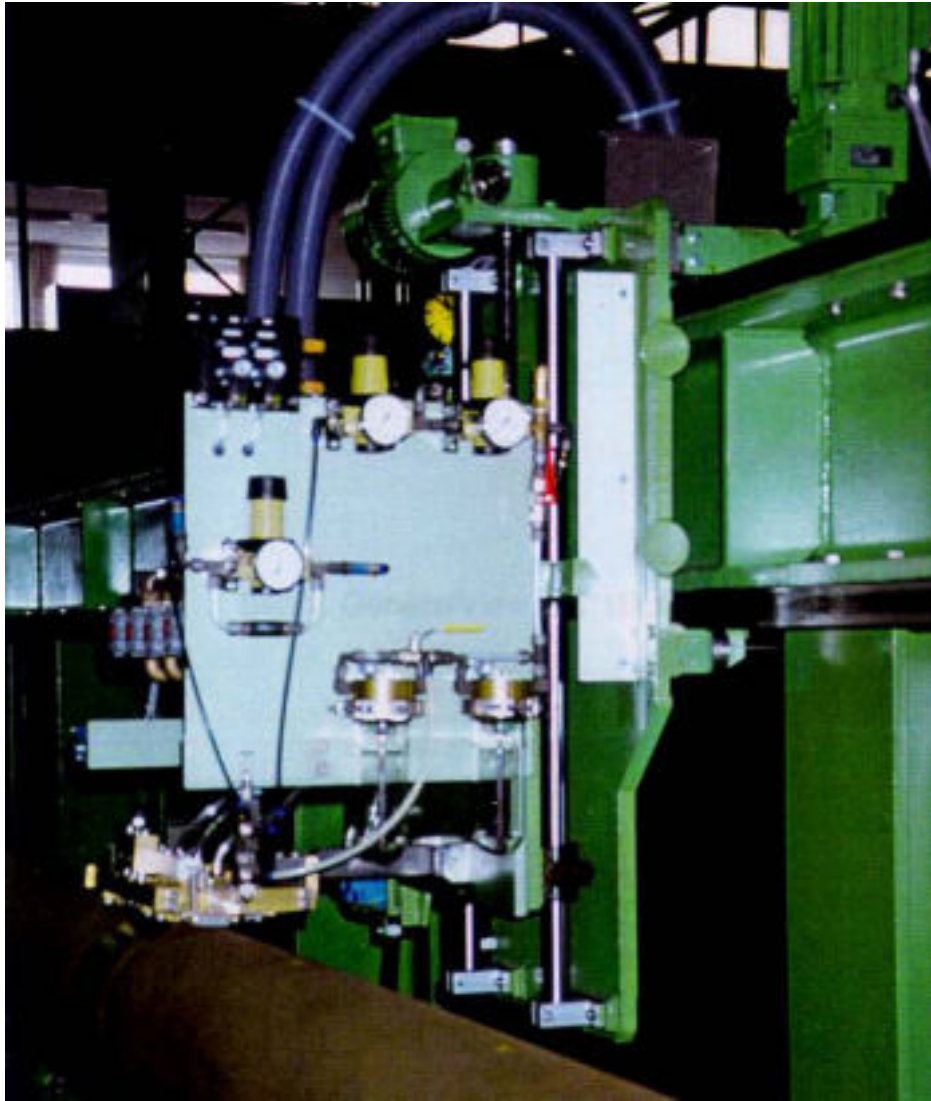


Rohrenden-Prüfung *Tube End Inspection*

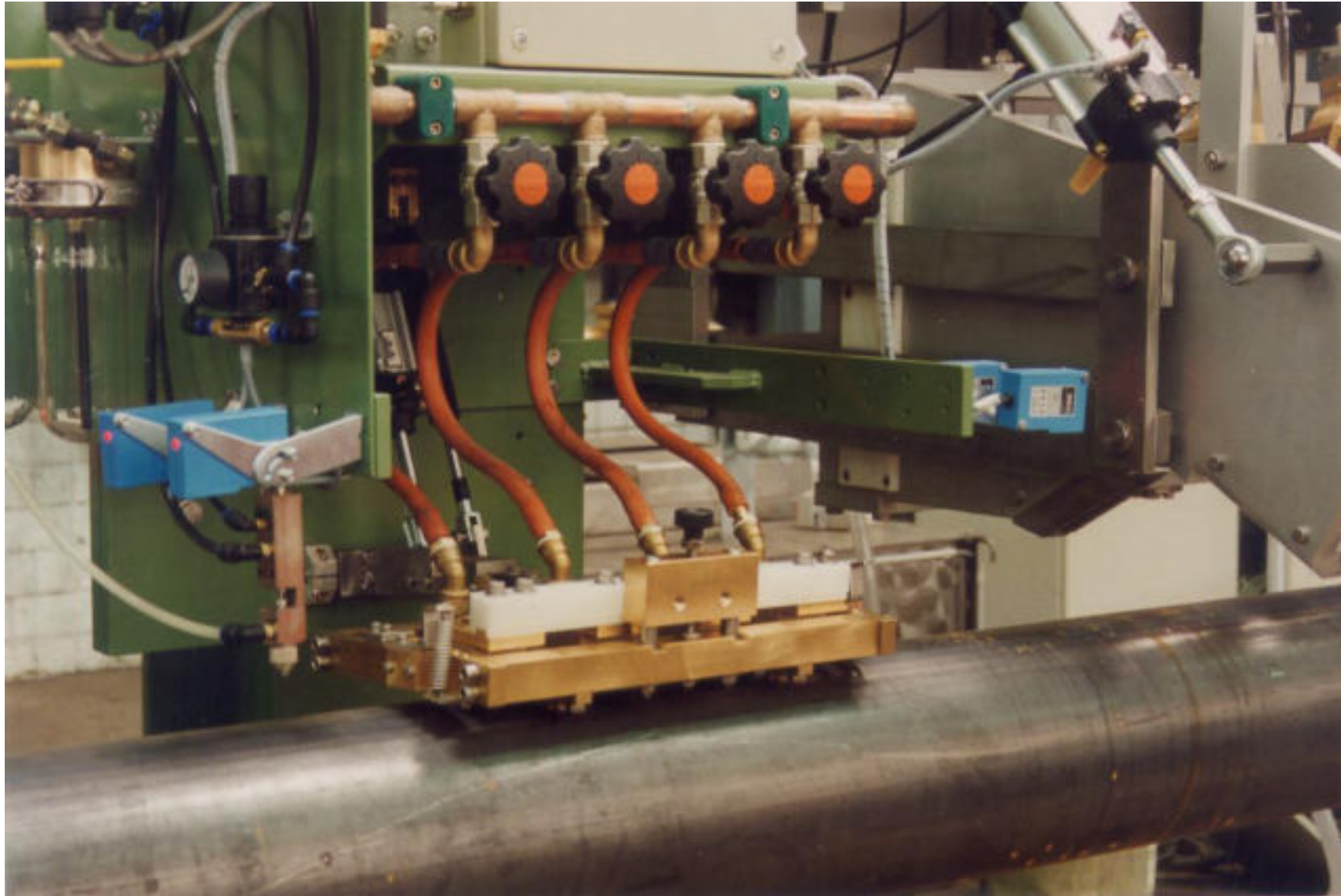


Testfehler
Test
Defect
3 x
Ø 1,6mm

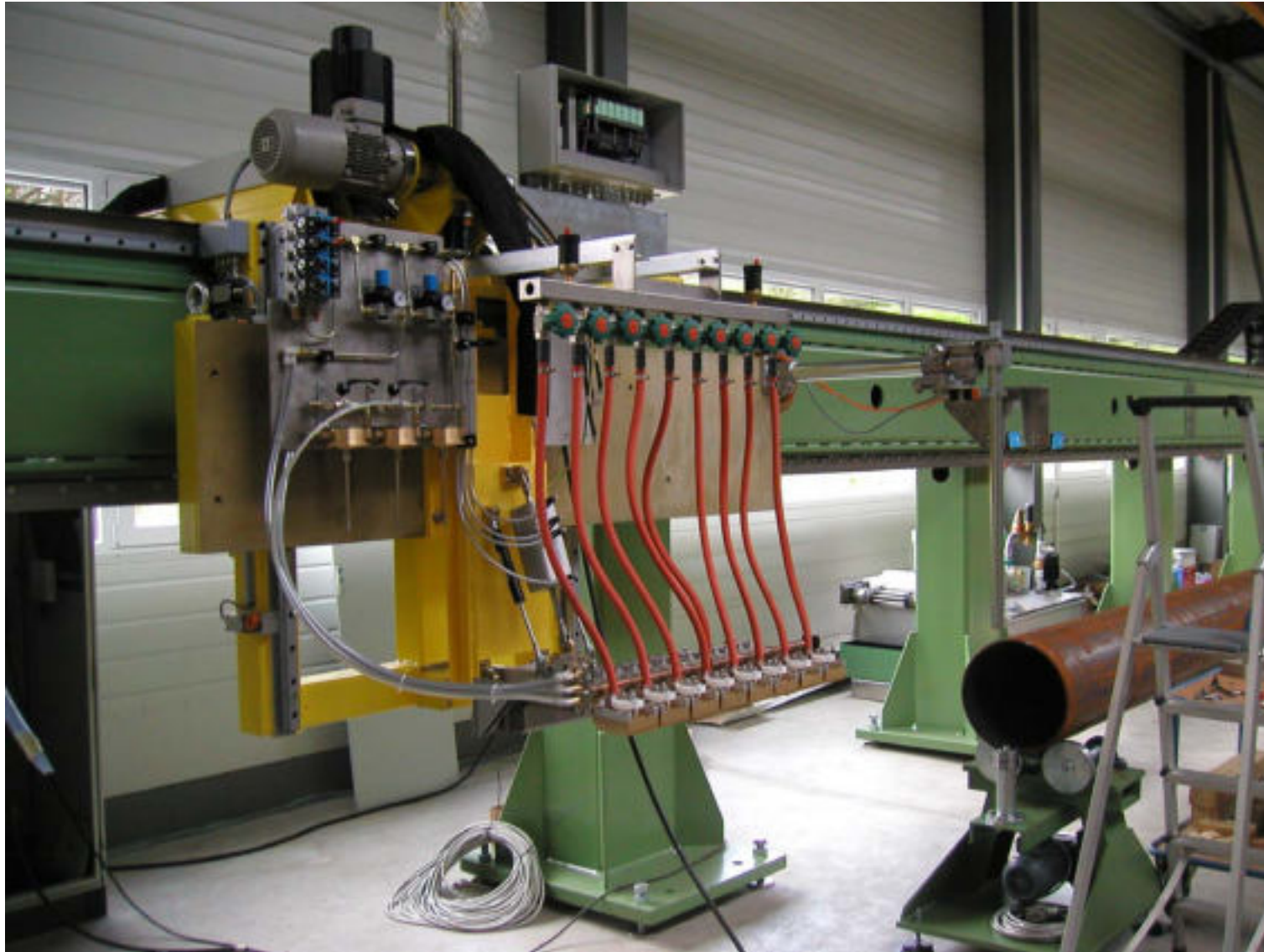
SNHF Amplitude über Rohrlänge *SNHF Amplitude vs. Pipe Length*



RPT.R Rotierprüftraverse *RPT.R Rotational Inspection Traverse*



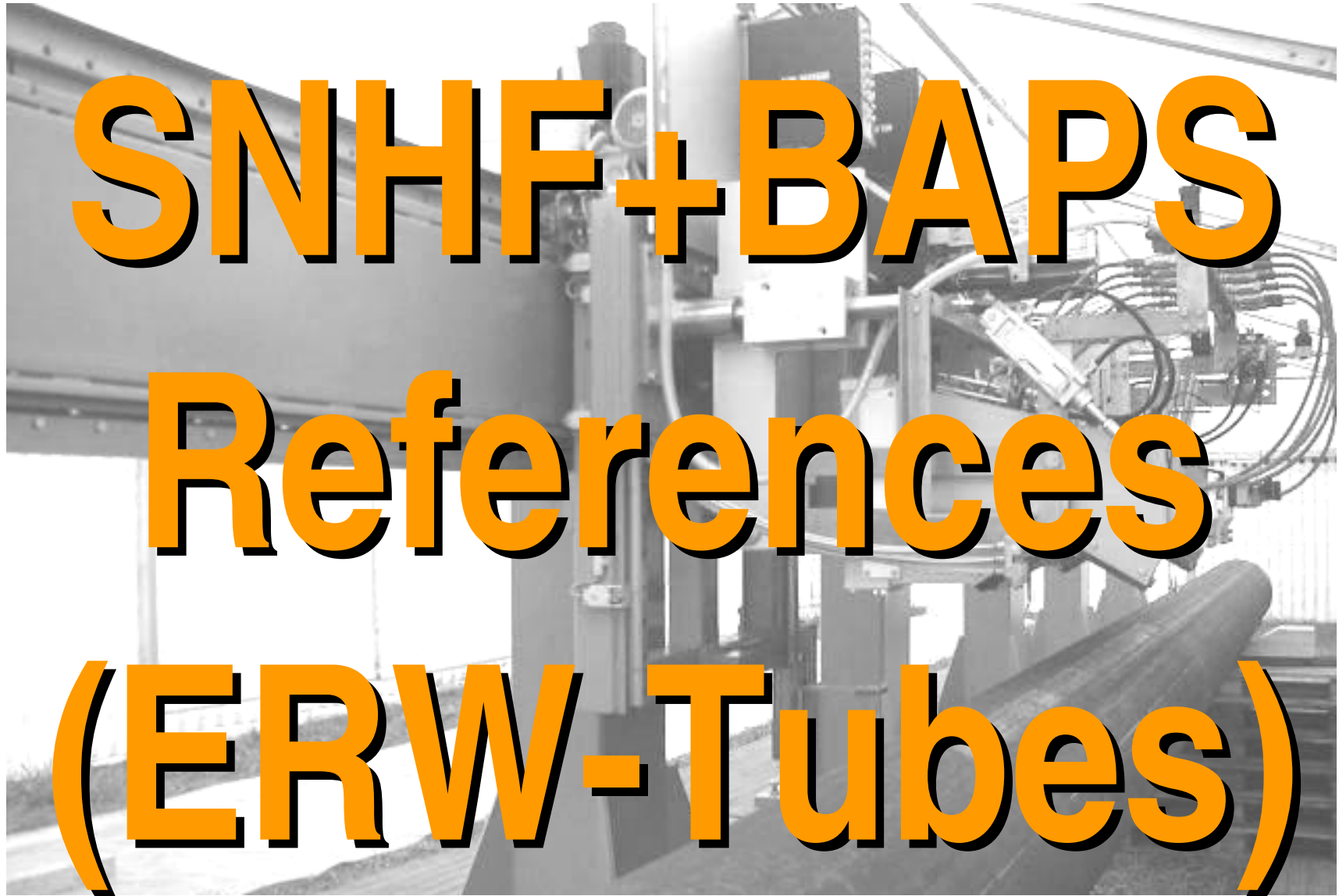
SNHF Volumenprüfung *SNHF helical full-body test*



RPT.R-FullBody-E1155-8DP (8 probes)



SNHF-offline Abtransport *SNHF-offline Prepare Shipping*



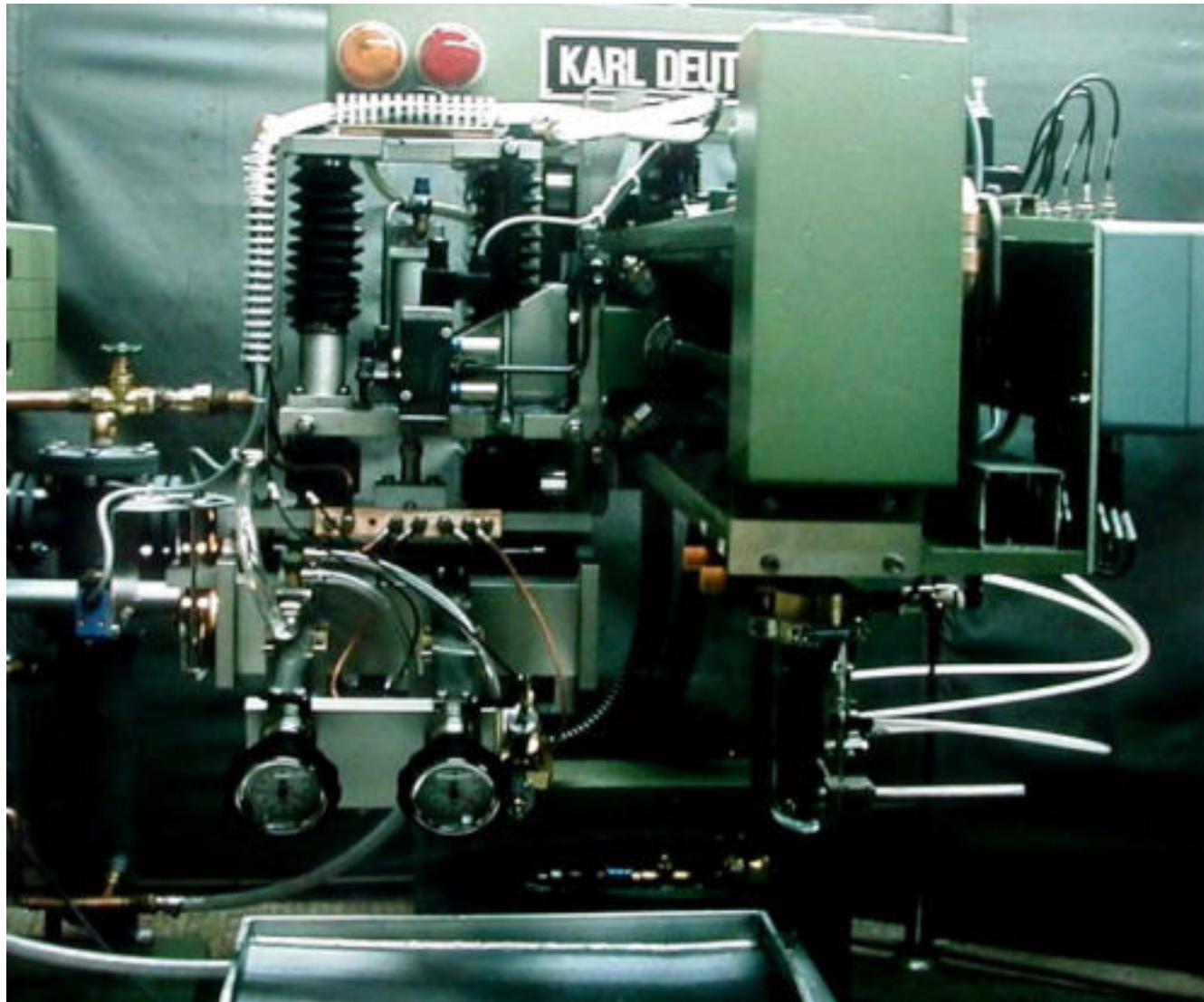
SNHF+BAPS

References

(ERW-Tubes)

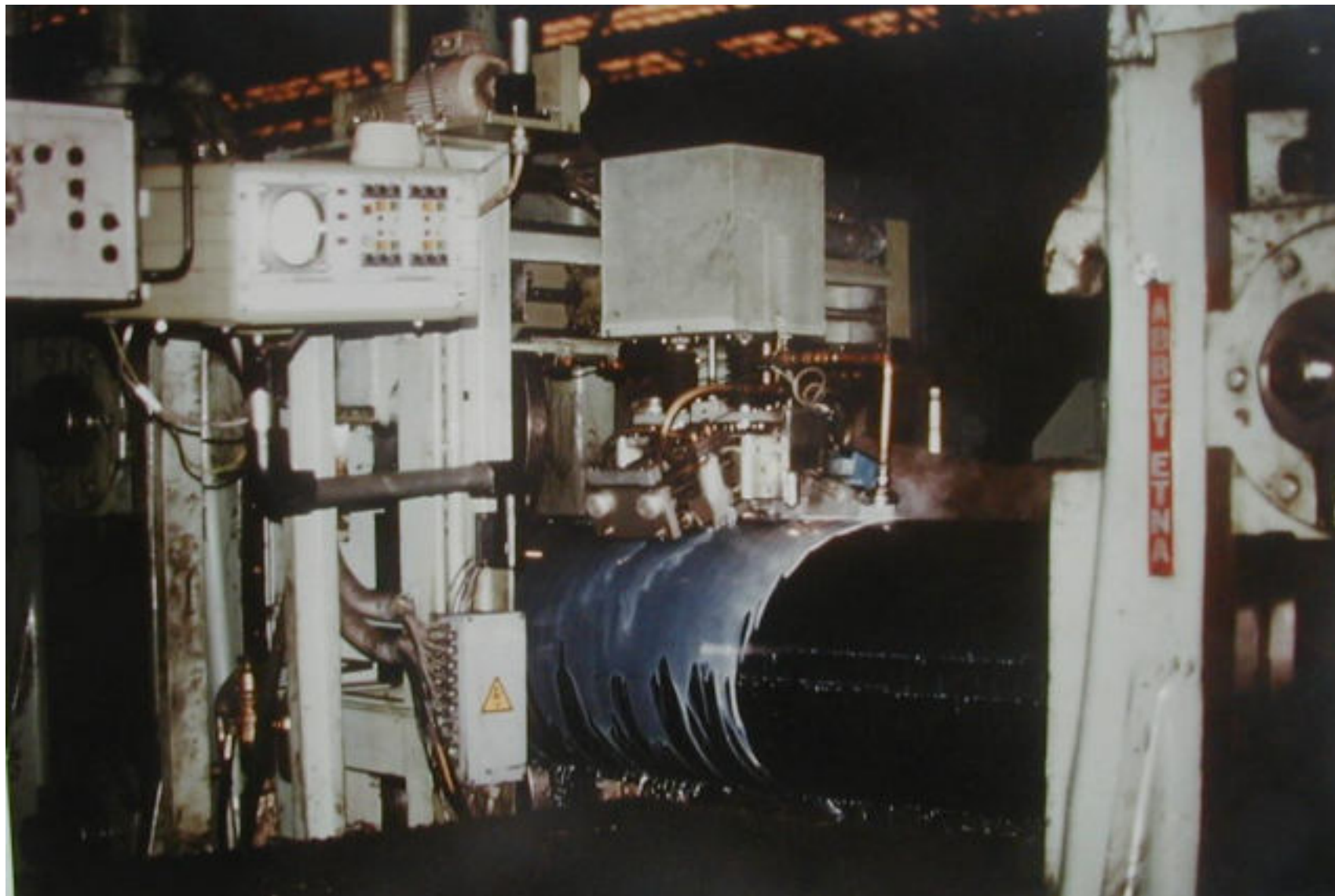
(SNHF = Schweiß-Naht Hoch-Frequenz)

KARL DEUTSCH



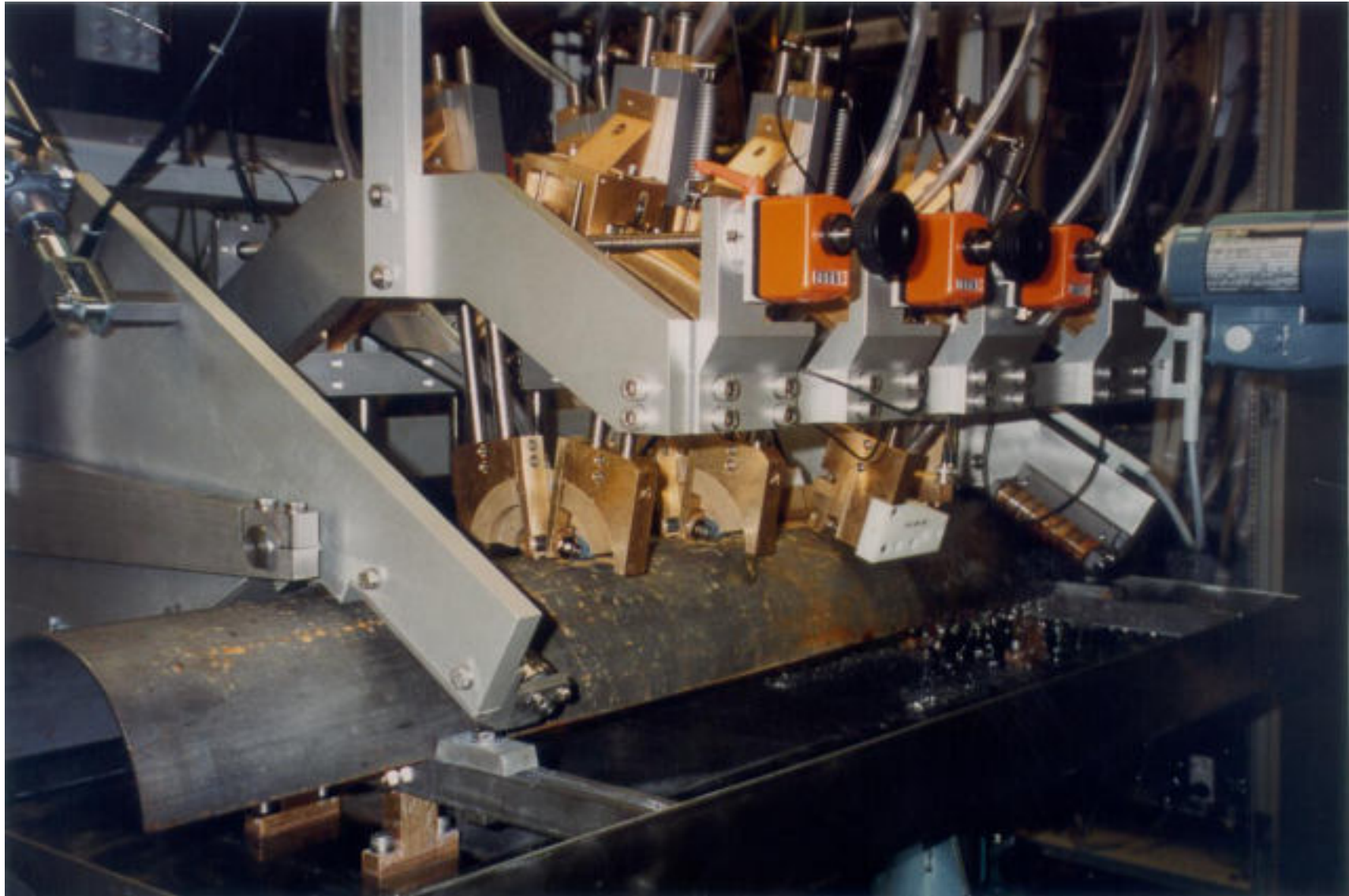
Hyundai Pipe, Korea 1990

KARL DEUTSCH

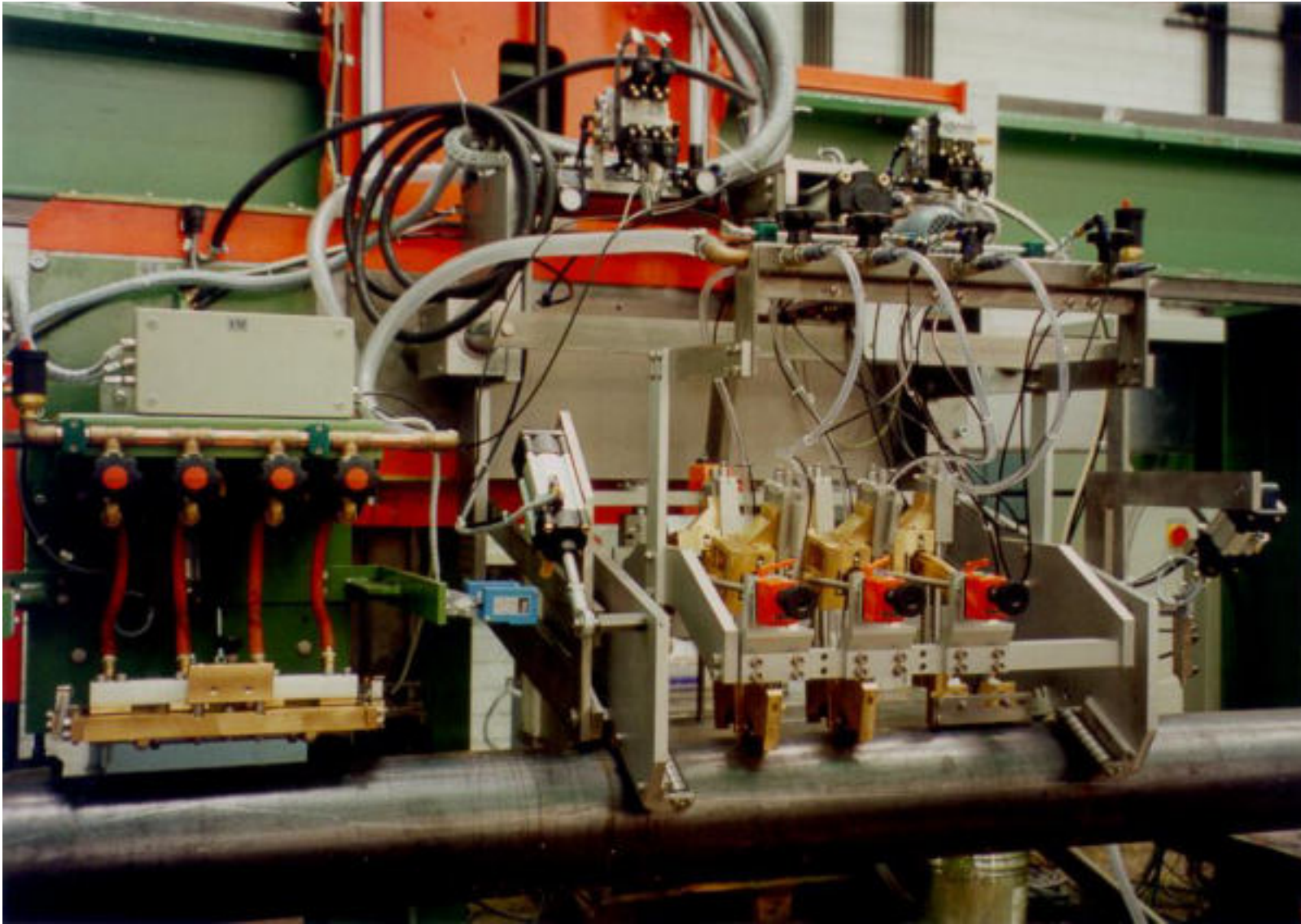


Pusan Steel Pipe, Korea 1990

KARL DEUTSCH

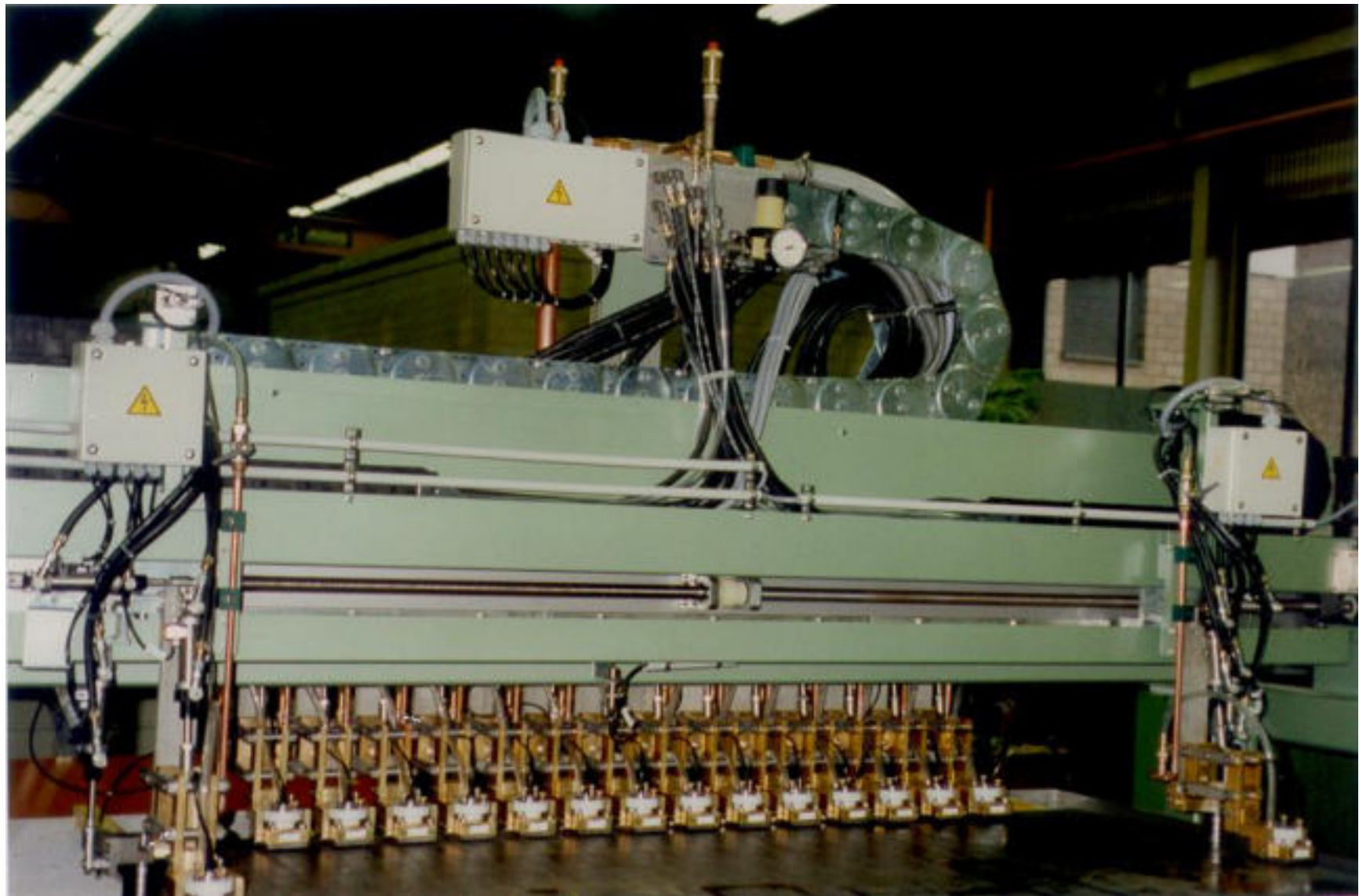


Shinho Steel, Korea 1994



Bakrie Pipe via DMS, Indonesia 1995

KARL DEUTSCH



BAPS-Echograph1030 (32 probes) @ Dalmine, Italy 1997

KARL DEUTSCH



BAPS-Echograph1155 (16 probes) @ Rourkela, India 2003

KARL DEUTSCH



Echograph 1155
2*2L
 $\varnothing = 219 - 508 \text{ mm}$
 $s = 3.2 - 12.7 \text{ mm}$
On-Line Test

SNHF-E1155 (4 probes) @ Rourkela India, via Salzgitter 2003

KARL DEUTSCH



Echograph 1155
4L 2Q 4DP 2RE
 $\varnothing = 219 - 508 \text{ mm}$
 $s = 3.2 - 12.7 \text{ mm}$
 $L_{\text{max}} = 12.4 \text{ m}$
Off-Line Test

SNHF-E1155 (12 probes) @ Rourkela India, via Salzgitter 2003

KARL DEUTSCH



SNHF-Echograph1030-4L2DP1OSC (7 probes) @ SAFA Iran 2004



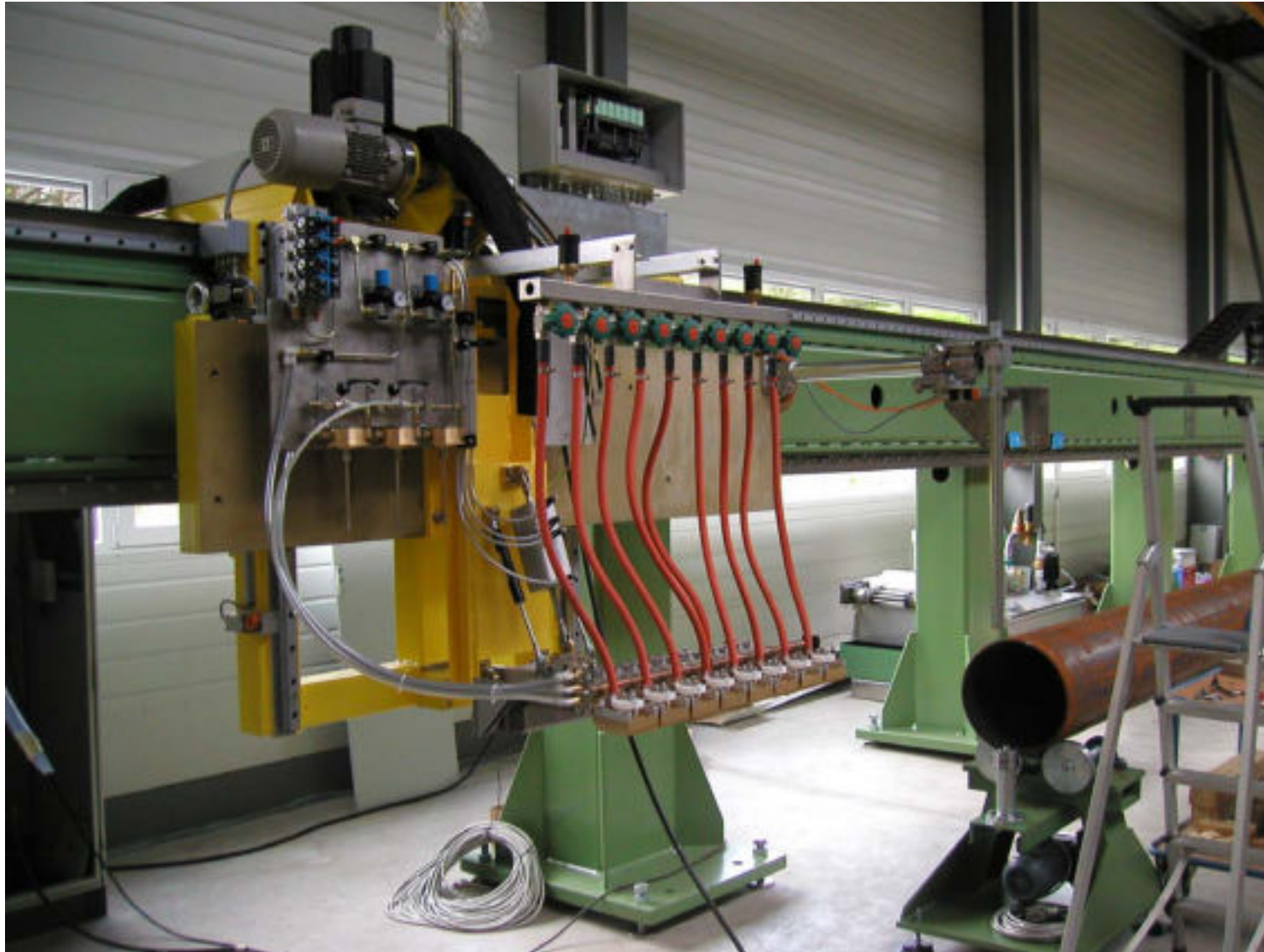
SNHF-Echograph1030-4L (4 probes) @ SAFA, Iran 2004

KARL DEUTSCH



SNHF-offline-E1155-4L2Q4DP (10 probes) @ Vyksa, Russia

(SNUL-SNUS Overview forPC Feb02, p. 123)



RPT.R-FullBody-E1155-8DP (8 probes) @ Vyksa, Russia



REPA-Echograph1030-2L1DP (3 probes) @ Vyksa, Russia

KARL DEUTSCH



BAPS-Echograph1155 (37 probes) @ Baosteel China 2005

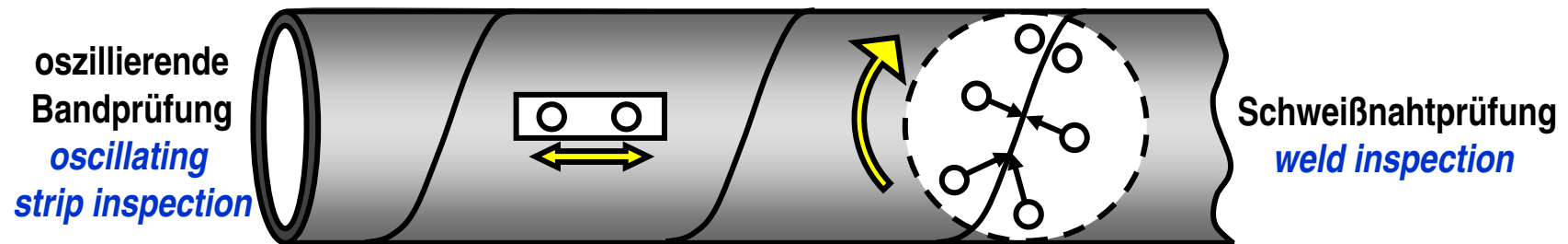


SNHF-online-E1155-4L4DP1OSC (9 probes) @ Baosteel China 2005

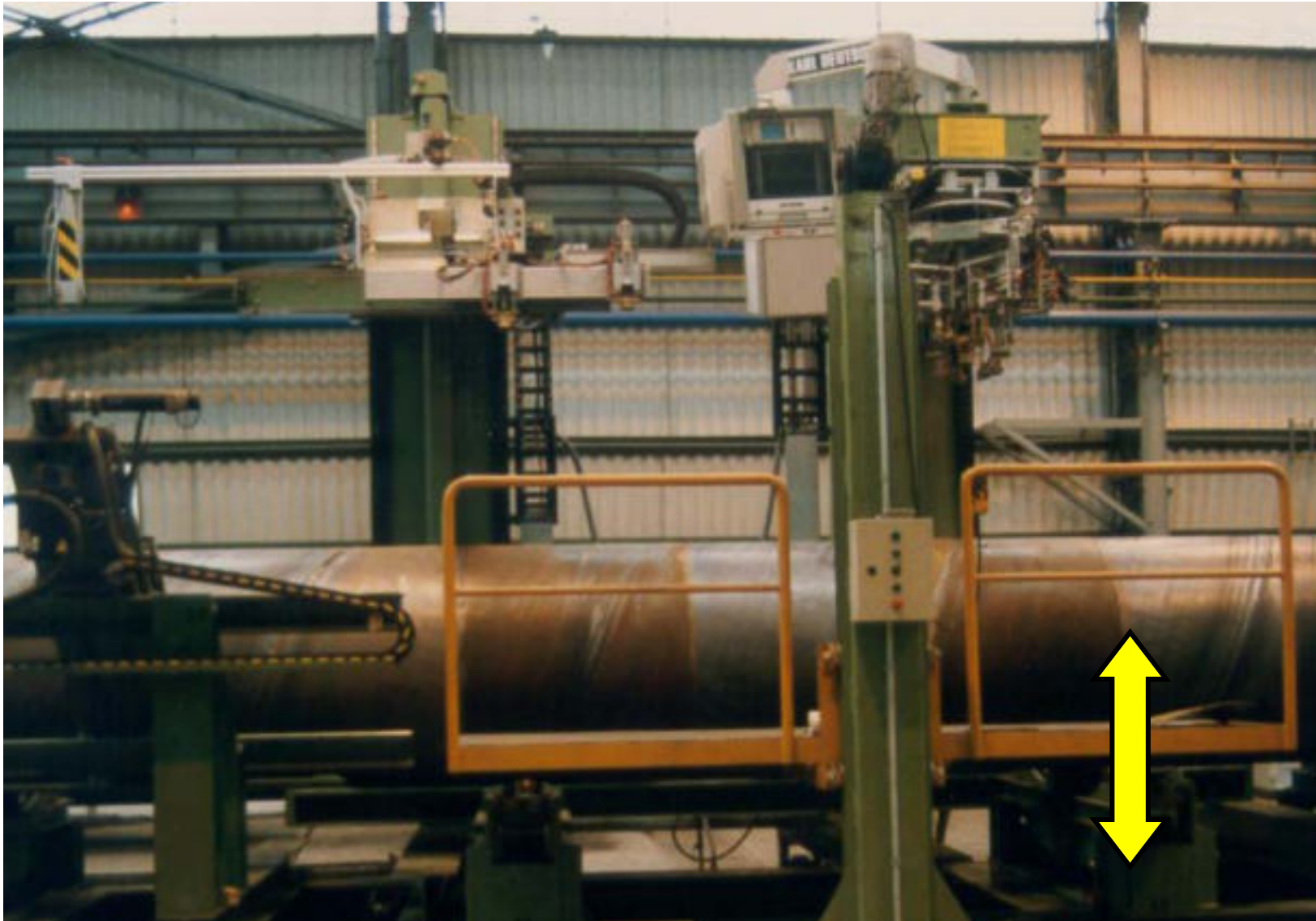


SNUS
Spiral Welds
SSAW-Pipes

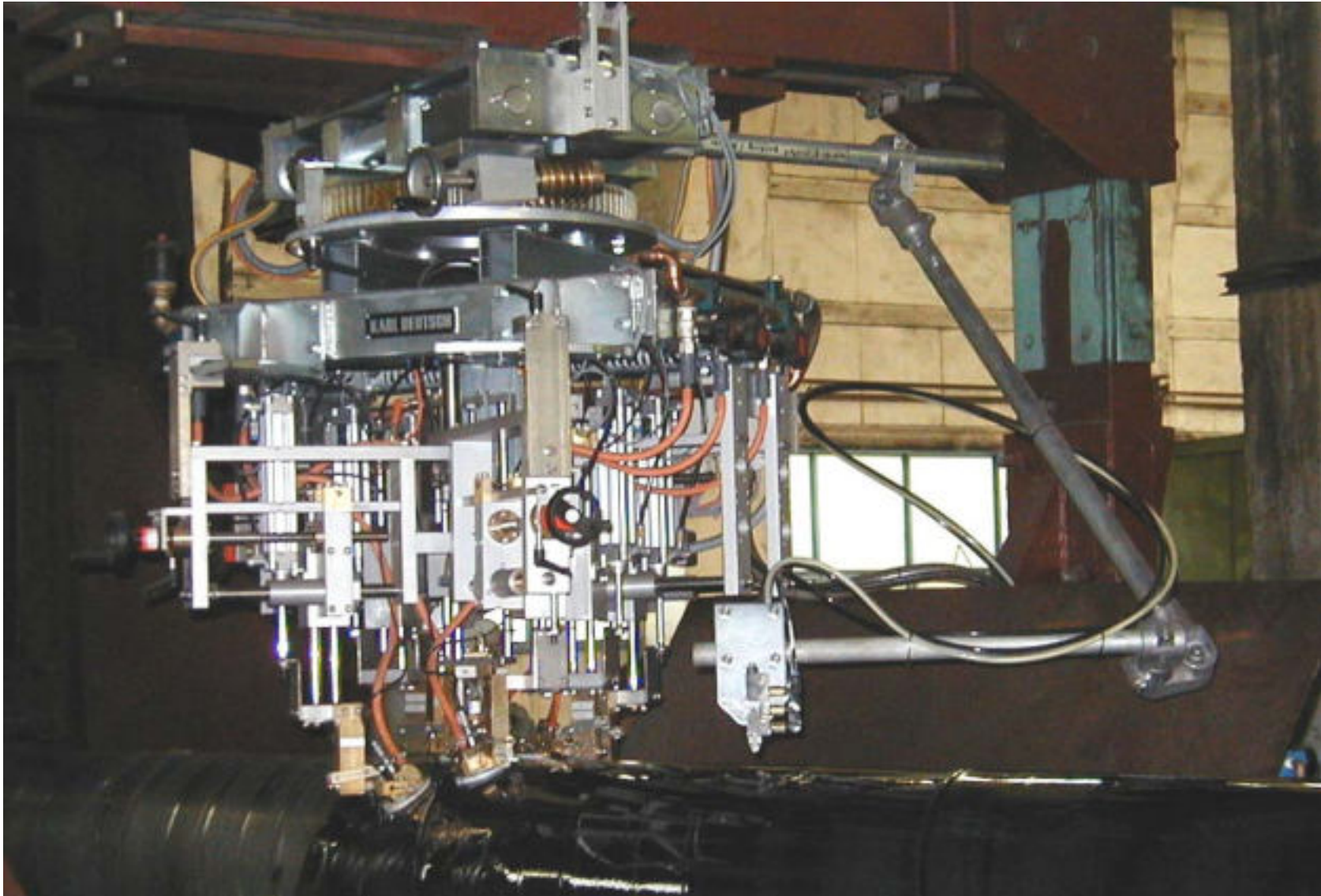
(SNUL = Schweiß-Naht Unter-Pulver Spiralnaht)



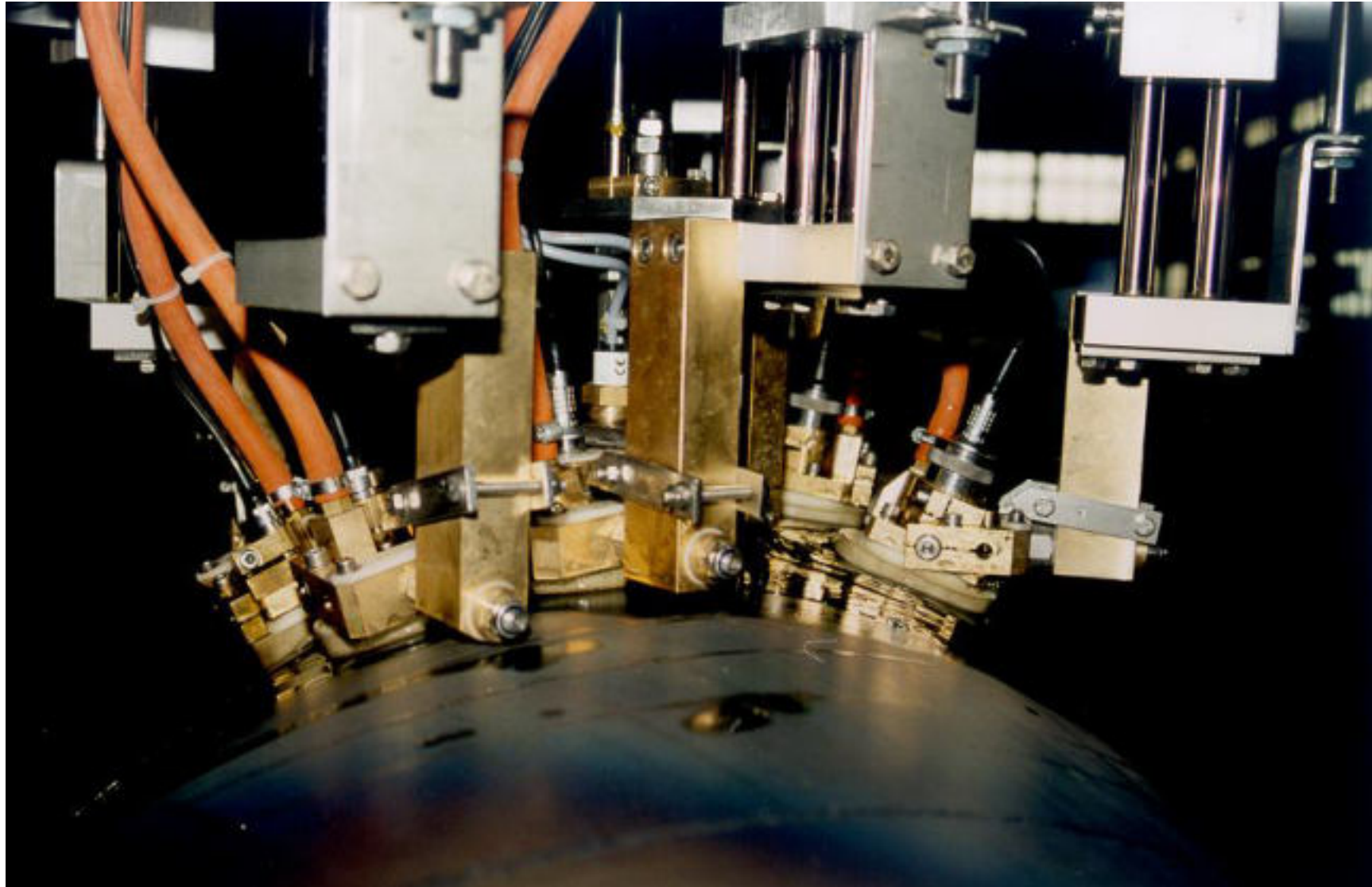
SNUS Spiralrohr-Prüfung *SNUS Spiral Tube Testing*



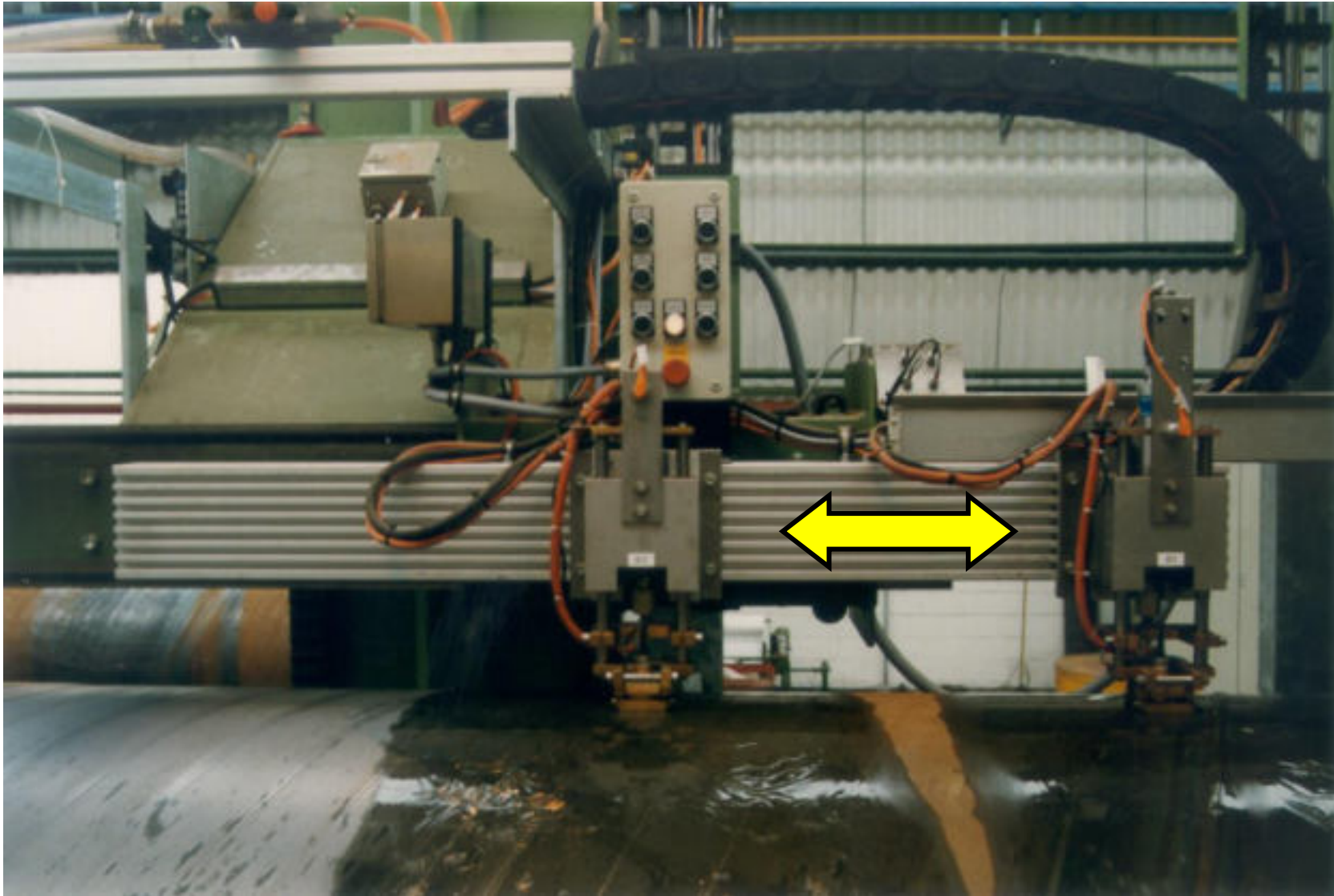
SNUS: Bediener-Plattform / *Operator Platform*



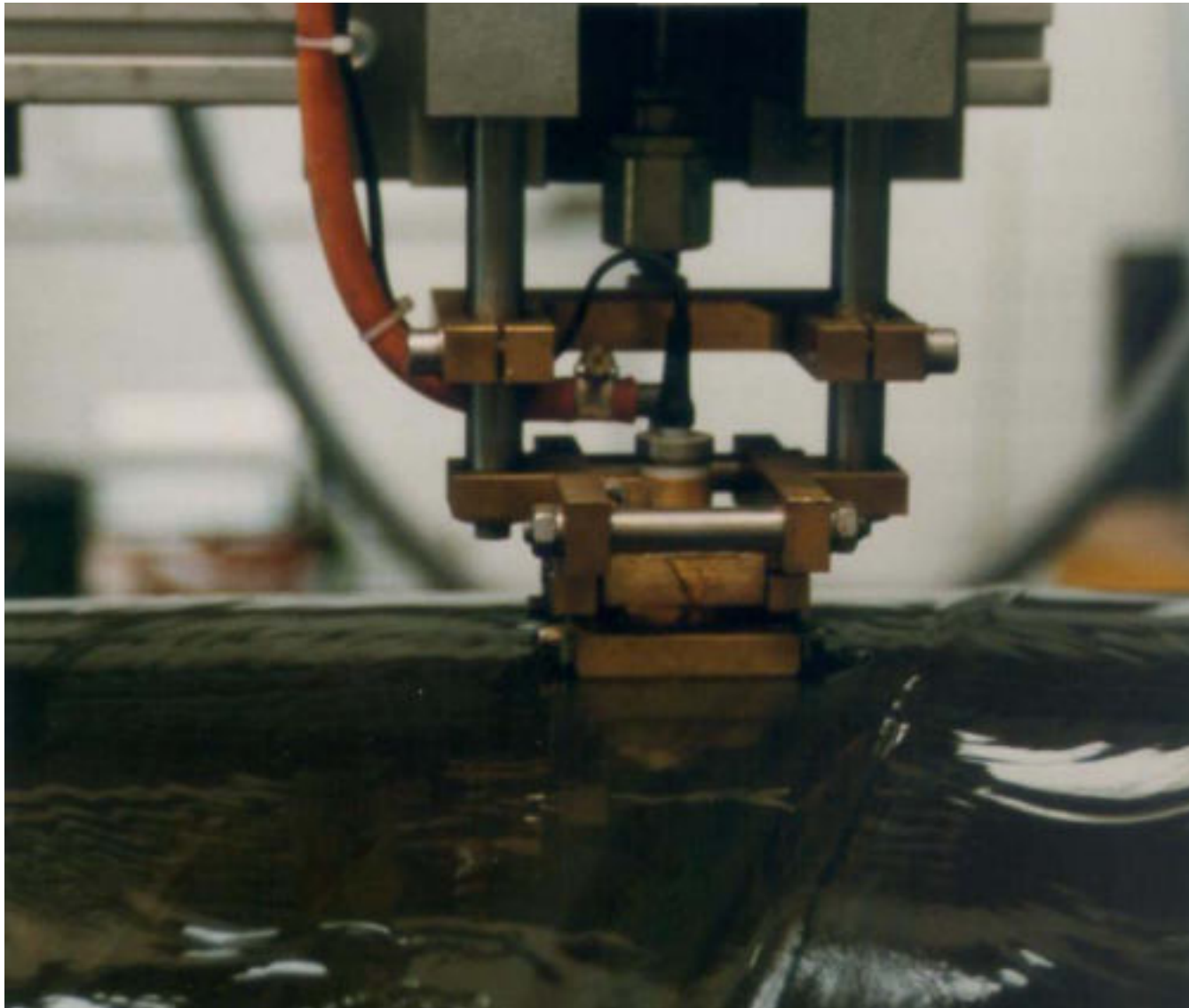
SNUS: 6 Prüfköpfe + FME *6 Probes + Flaw Marking*



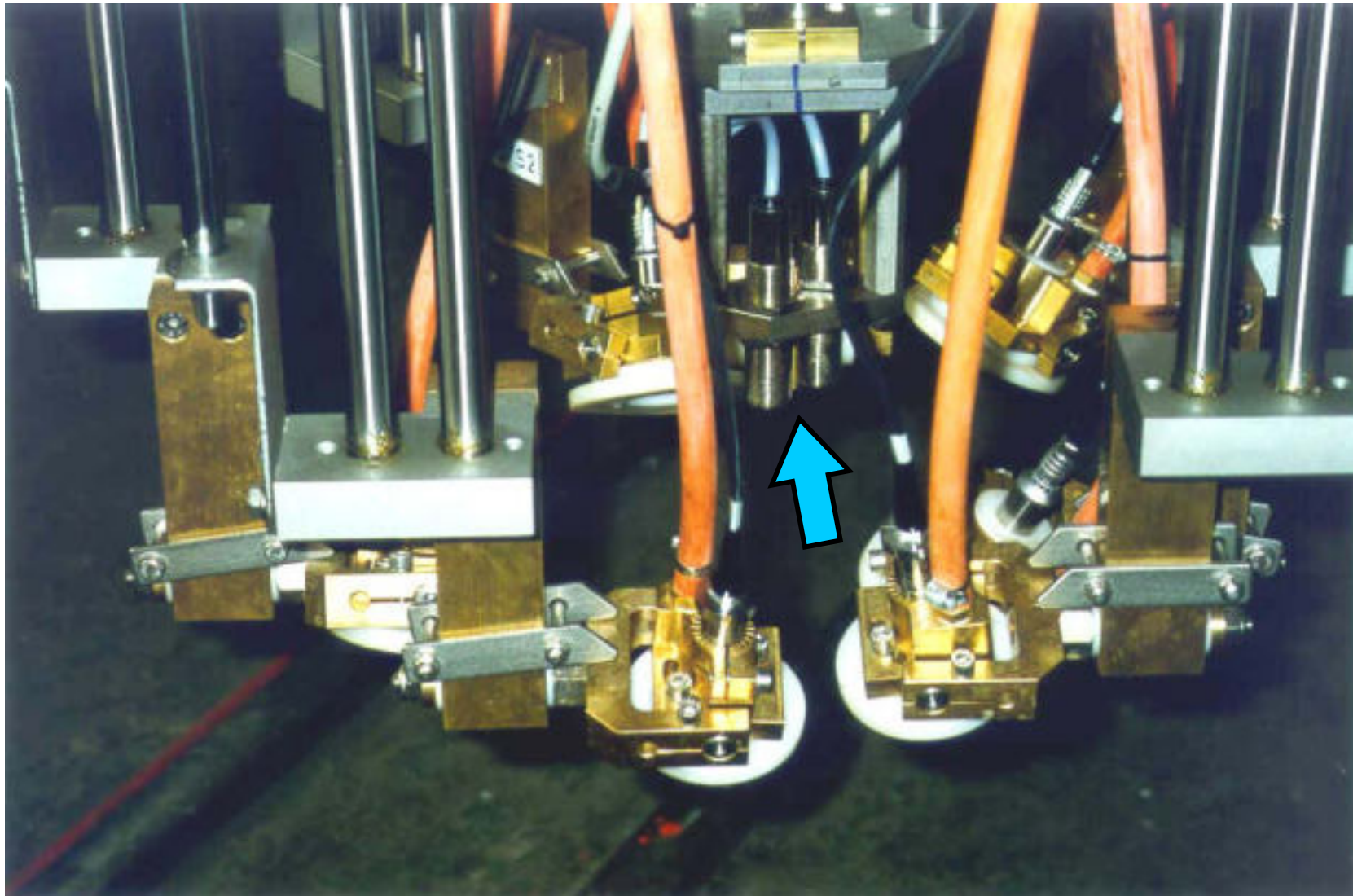
SNUS: Prüfkopfträger *Probe Carriers*



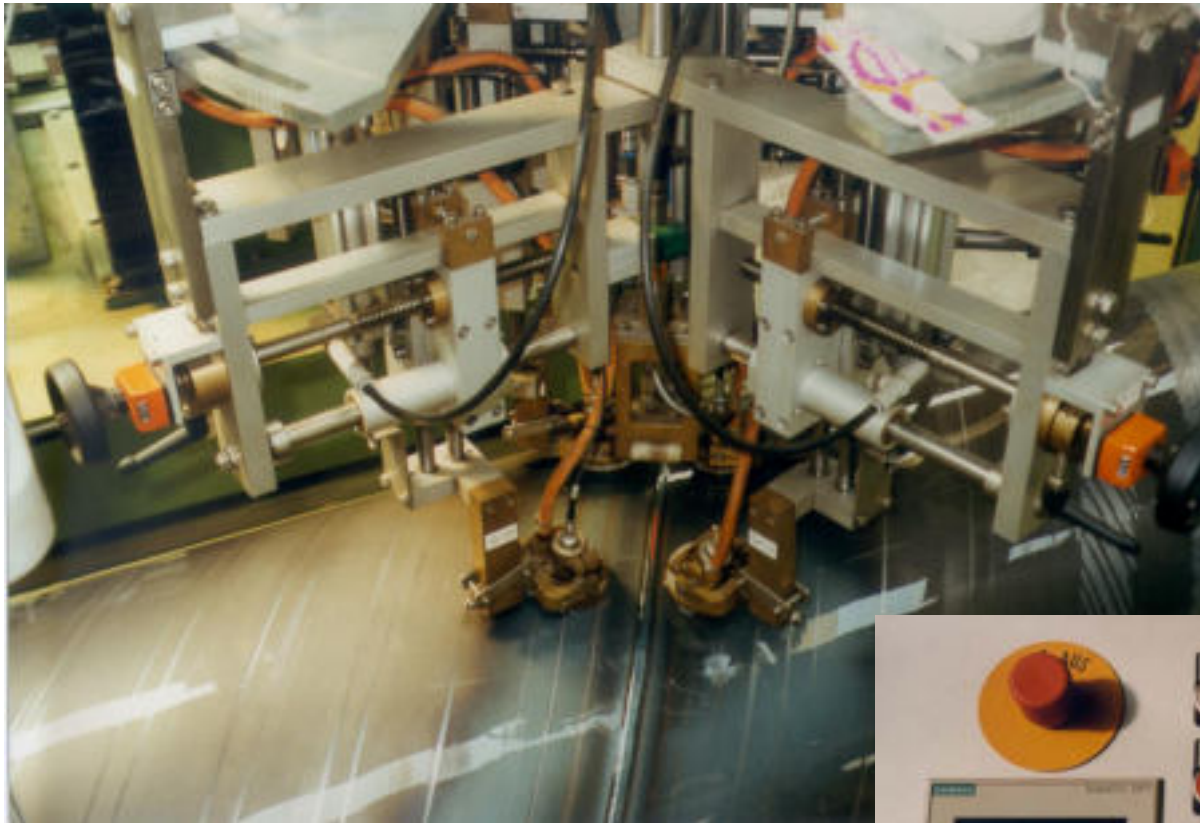
SNUS: osz. Bandprüfung *osc. strip inspection*



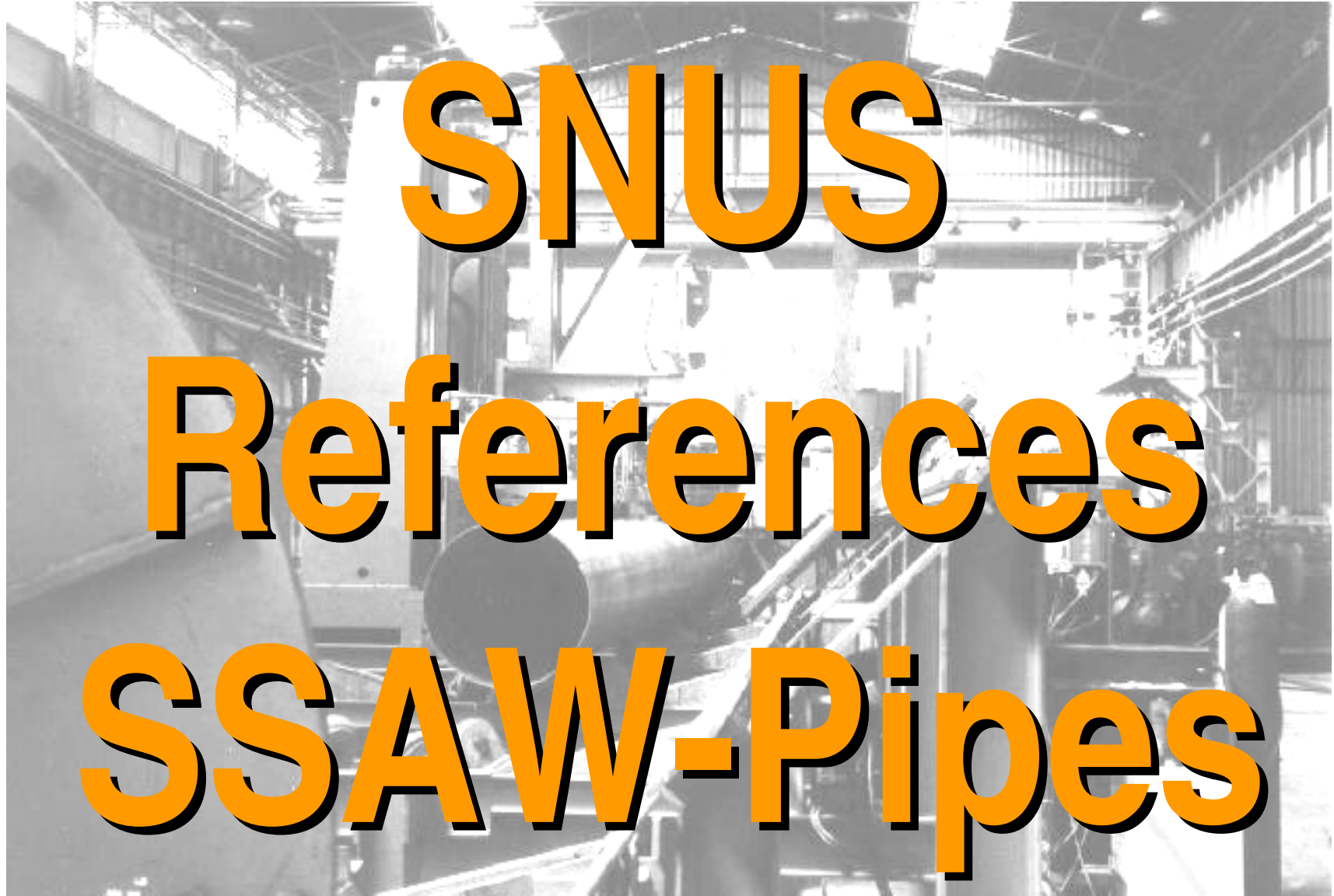
SNUS: osz. Bandprüfung / osc. strip inspection



SNUS: Schweißnaht Verfolgung / Seam Tracking



SNUS: Schweißnaht Verfolgung / Seam Tracking



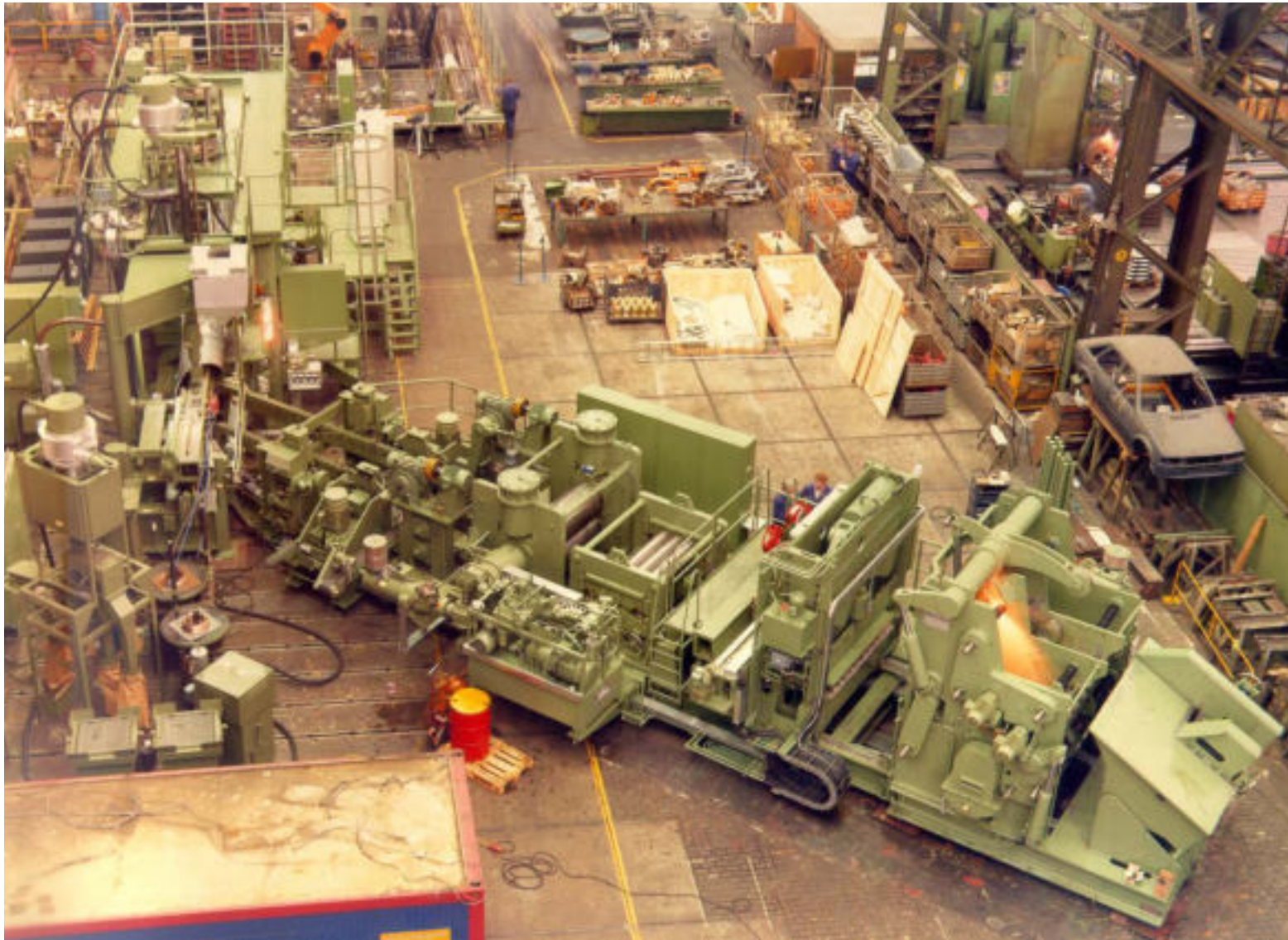
SNUS

References

SSAW-Pipes

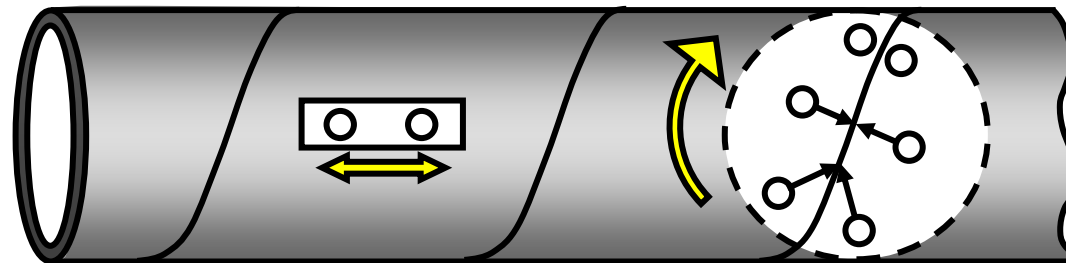
(SNUL = Schweiß-Naht Unter-Pulver Spiralnaht)

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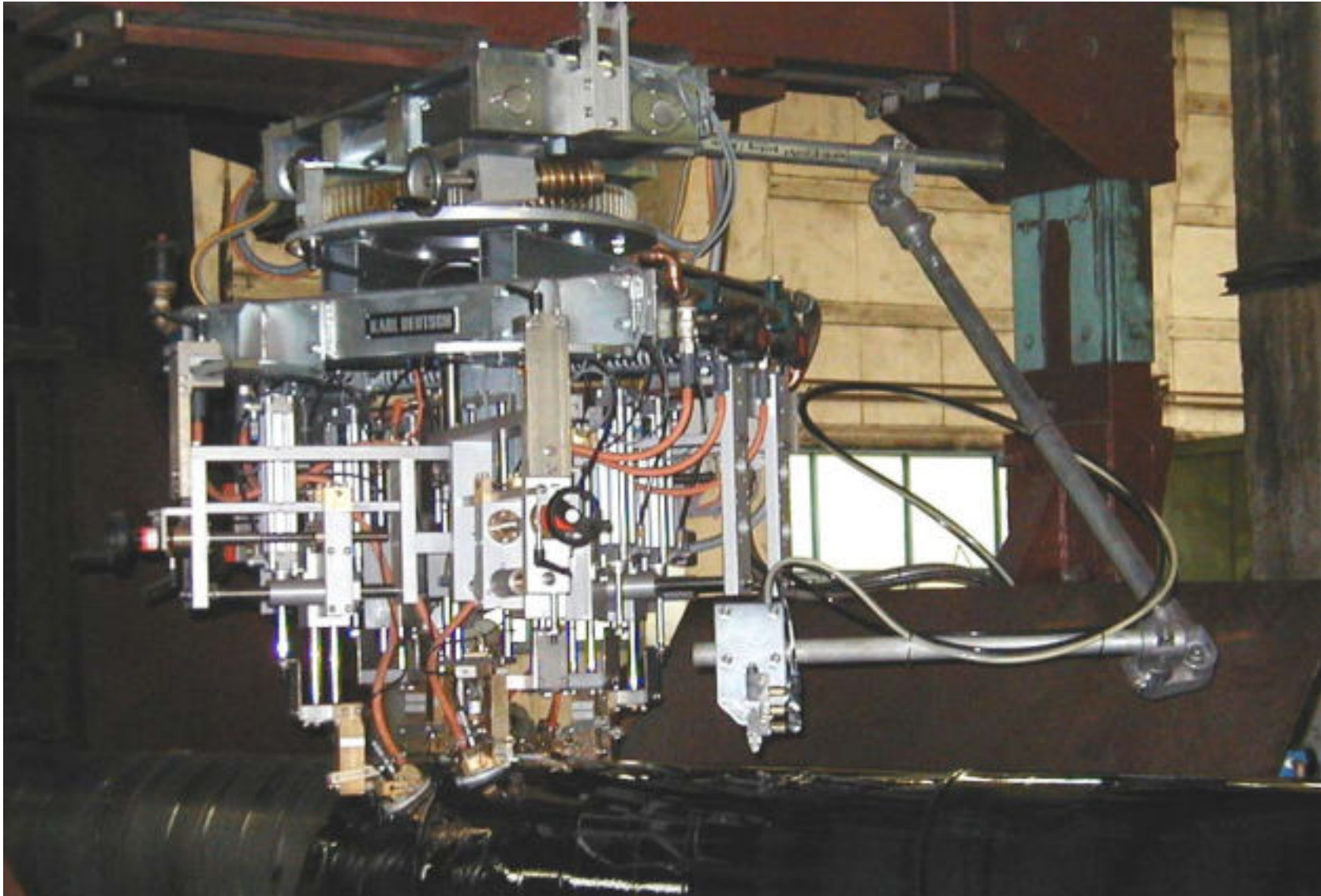
Sharjah Pipe via Blohm&Voss, Vereinigte Arab. Emirate 1984

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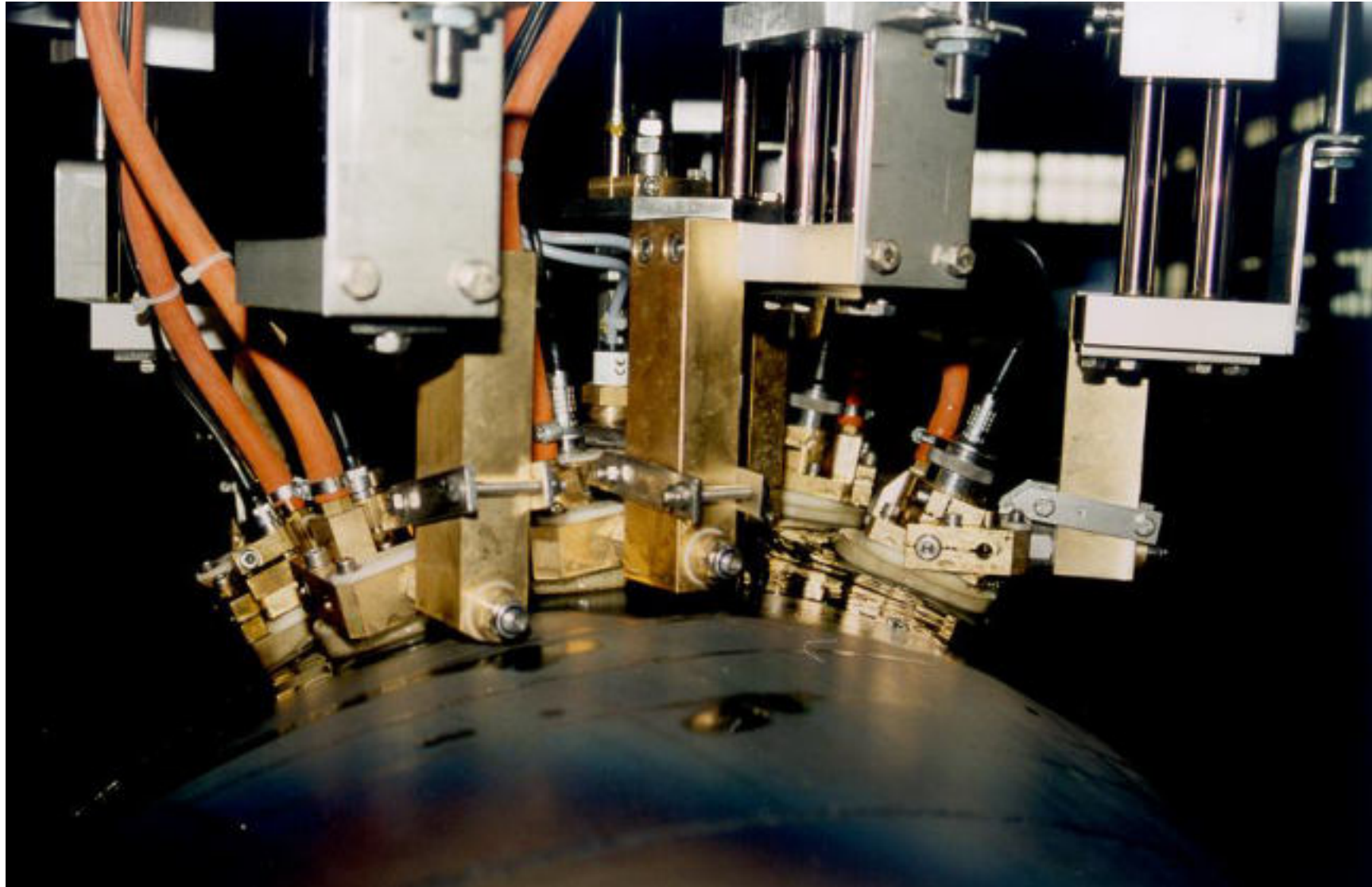
Confab Tubos SNUS-E1150-2L2Q2DP2DPO (8 probes), Brazil 1998

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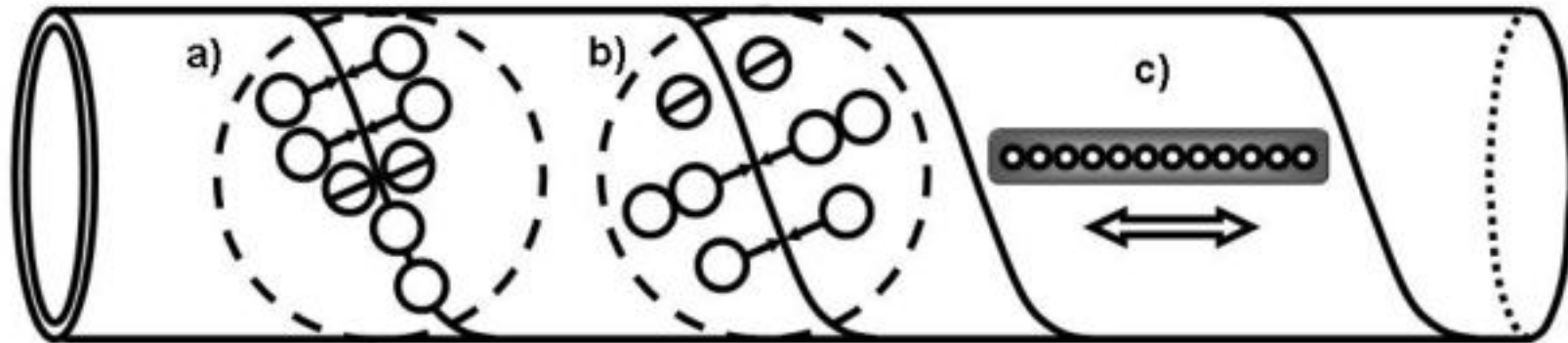
Eurosteel (formerly Helitube), Romania 1999

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Echograph 1030-2L2Q2WD @ Zimtube, Romania 2001

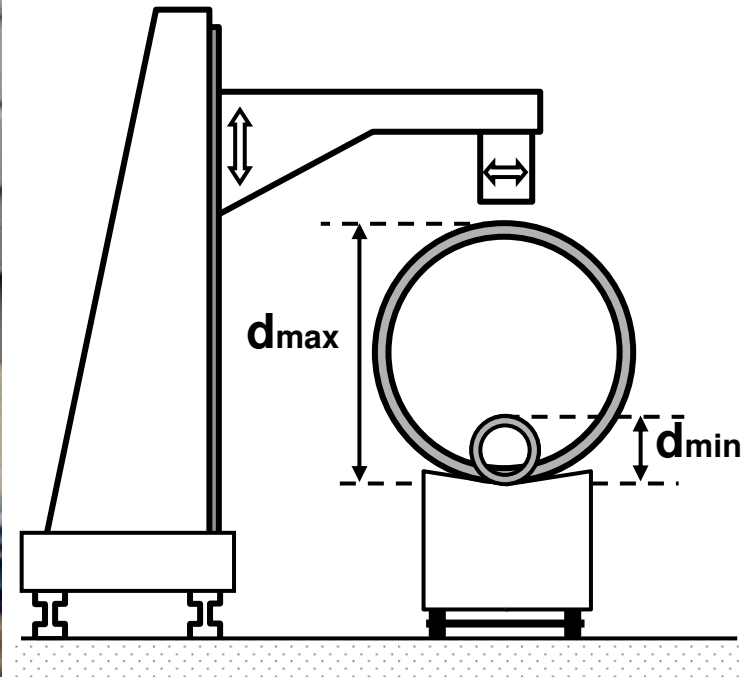
(SNUL-SNUS Overview forPC Feb02, p. 141)



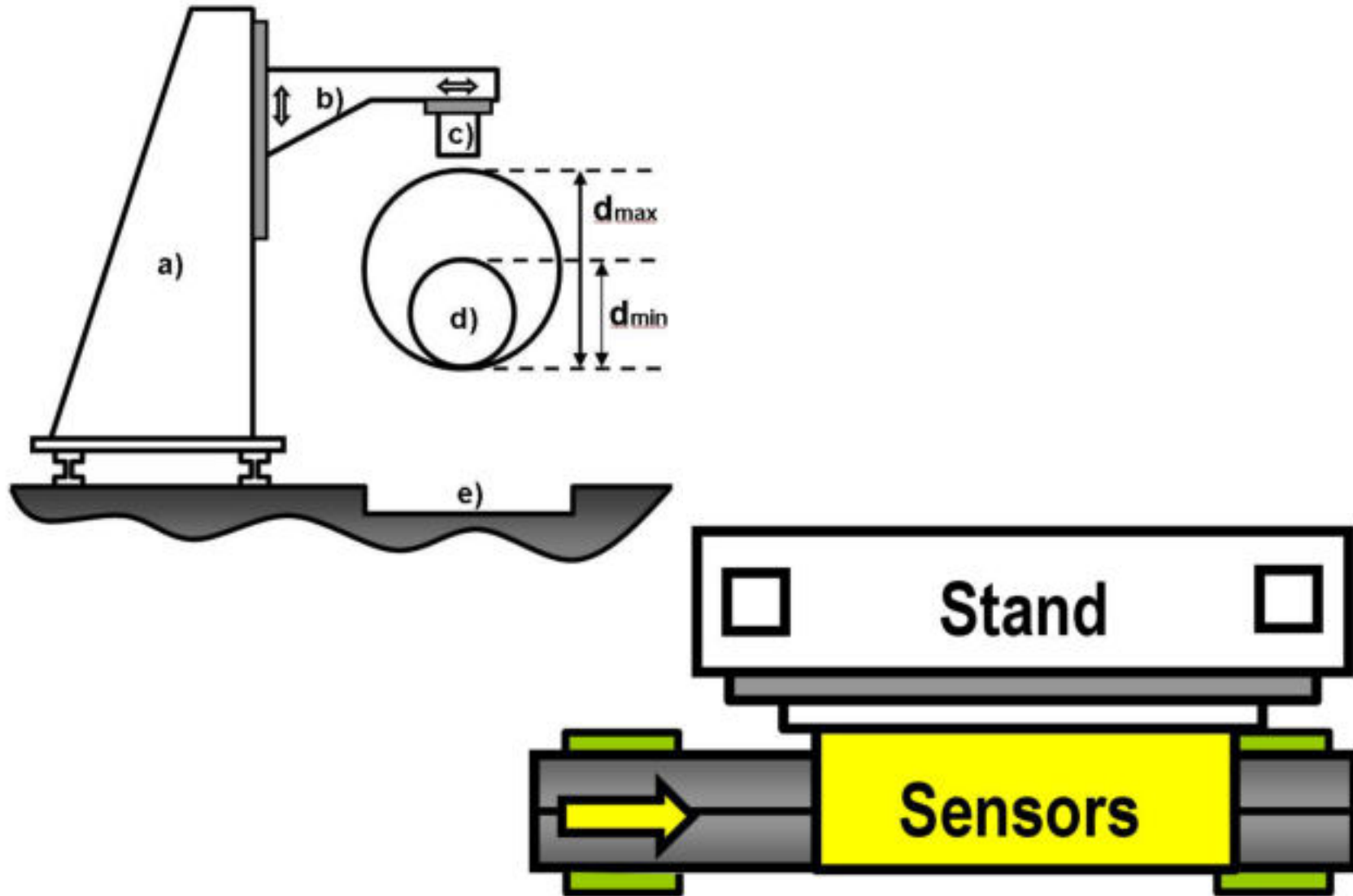
Echograph 1155-6L4T2Q4DP @ SAFA Iran 2007/2008



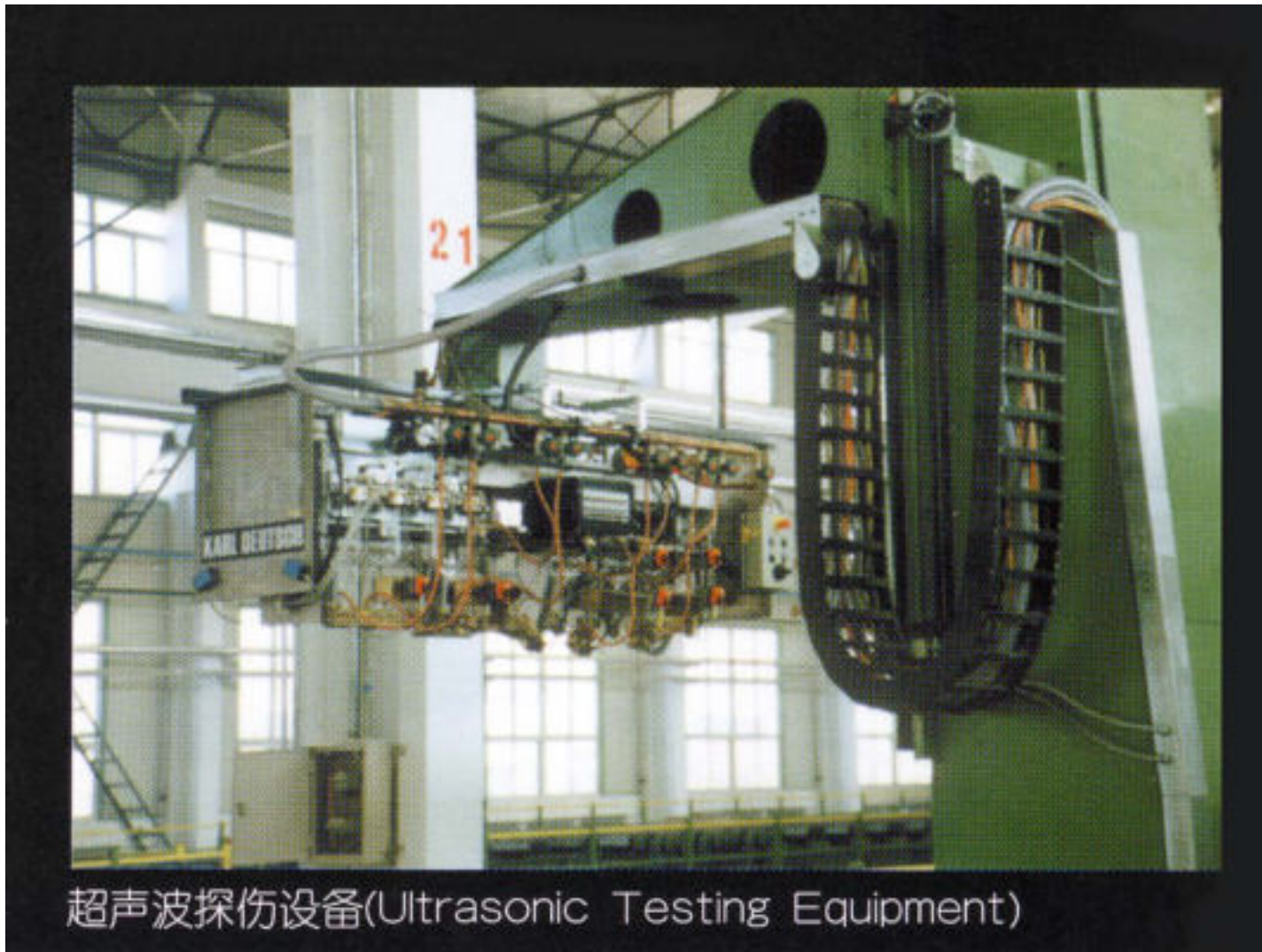
(SNUL = Schweiß-Naht Unter-Pulver Längsnaht)



SNUL-Echograph: UP-Längsnaht *LSAW-Pipe Testing*



SNUL-Echograph1155: Konzept Ausleger+Rohrwagen *Machine Stand + Pipe Carriage*



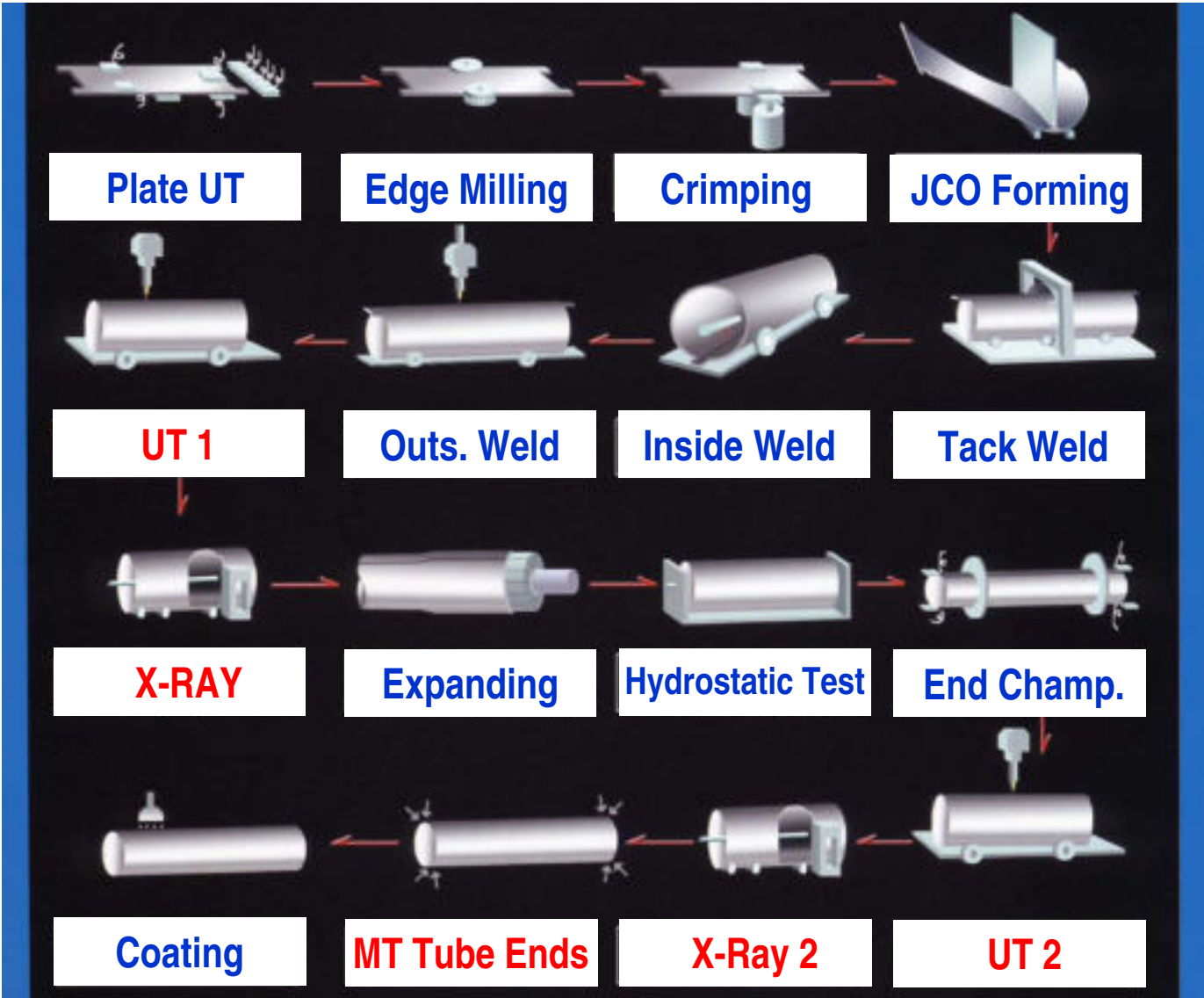
SNUL Maschinen-Ständer *SNUL Machine Frame (Stand+Boom)*



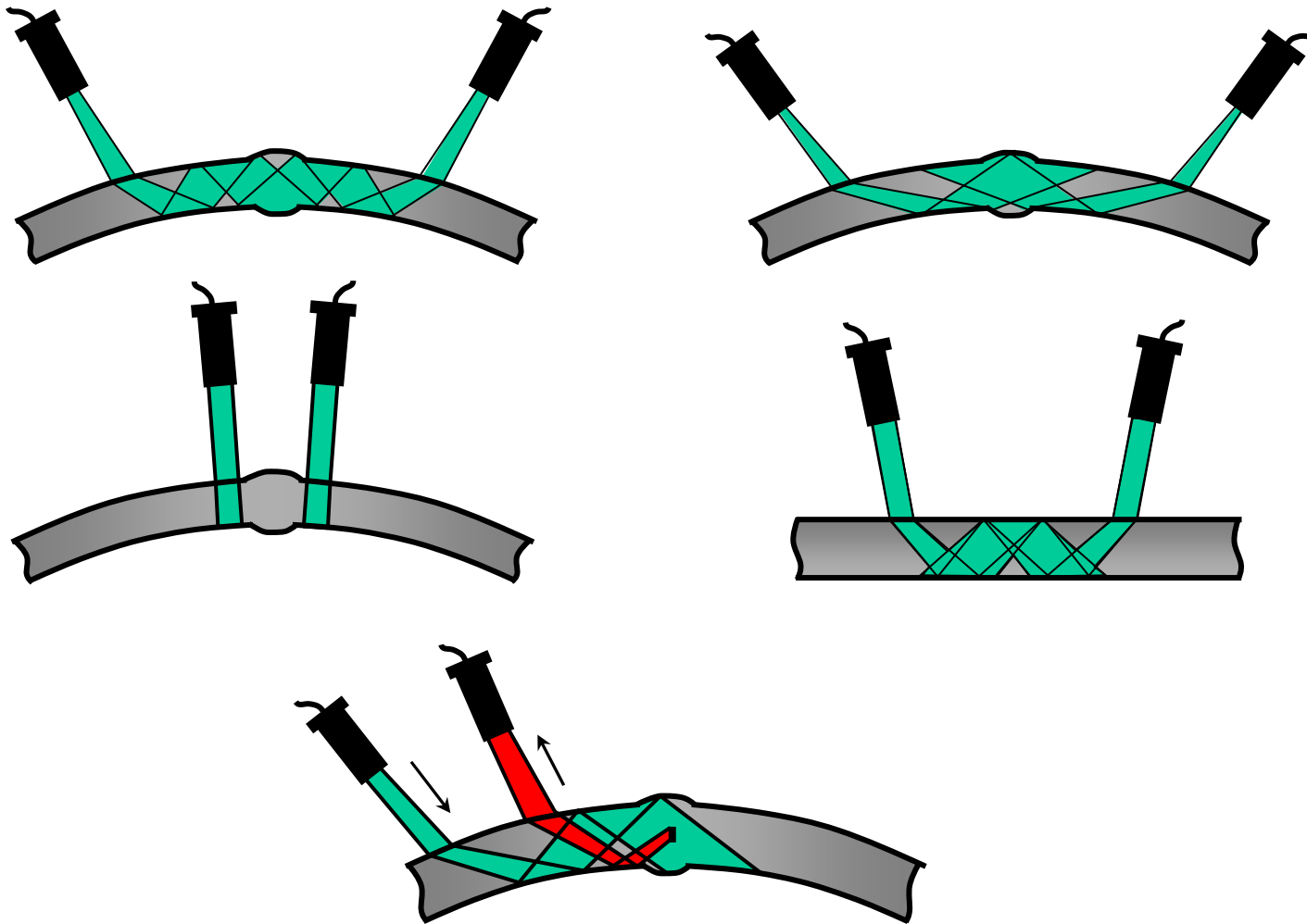
SNUL Rohrwagen *SNUL Pipe Carriage (Julong China)*



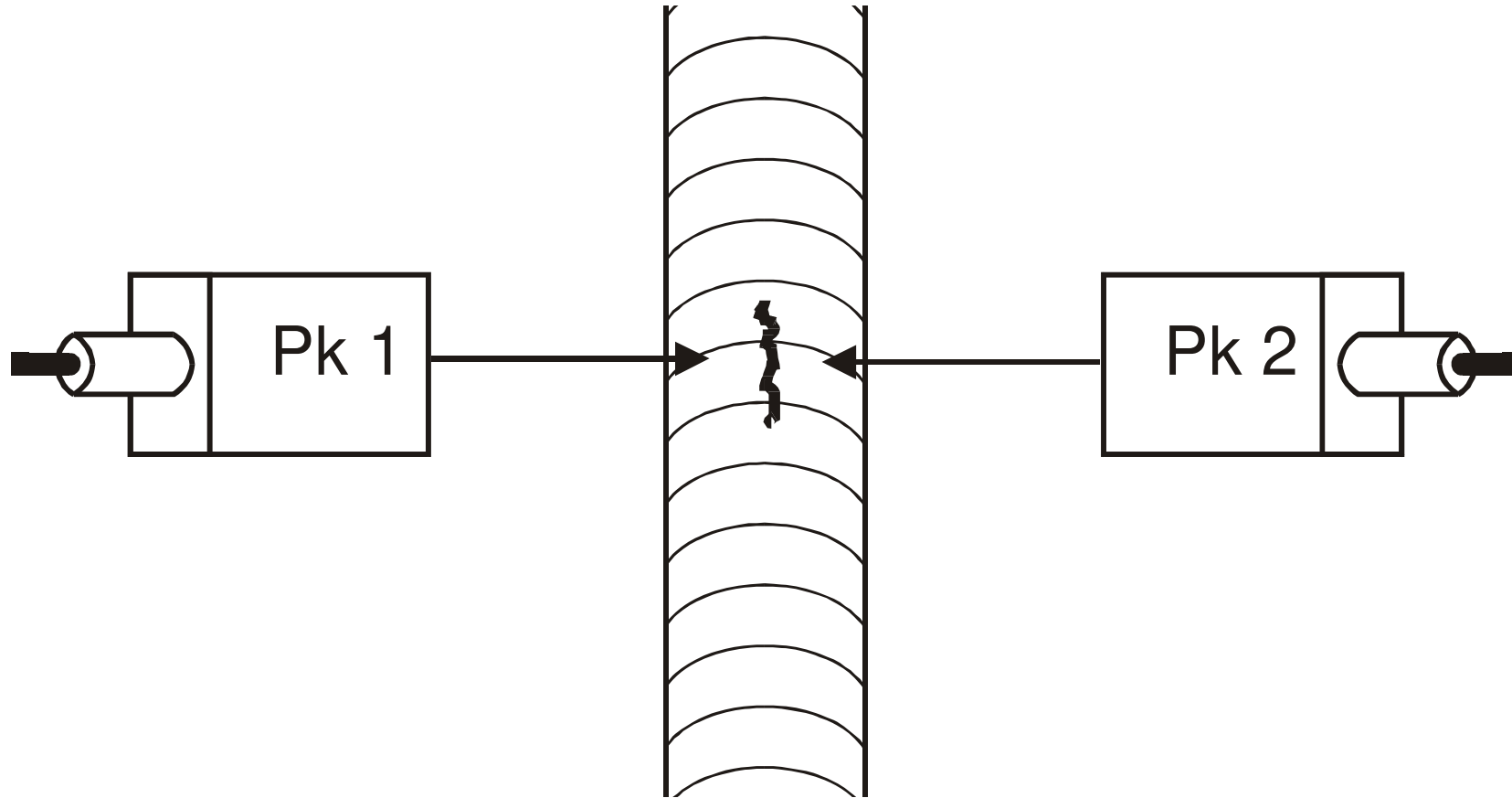
SNUL-Echograph1155: Maschinen-Ständer *Machine Stand*



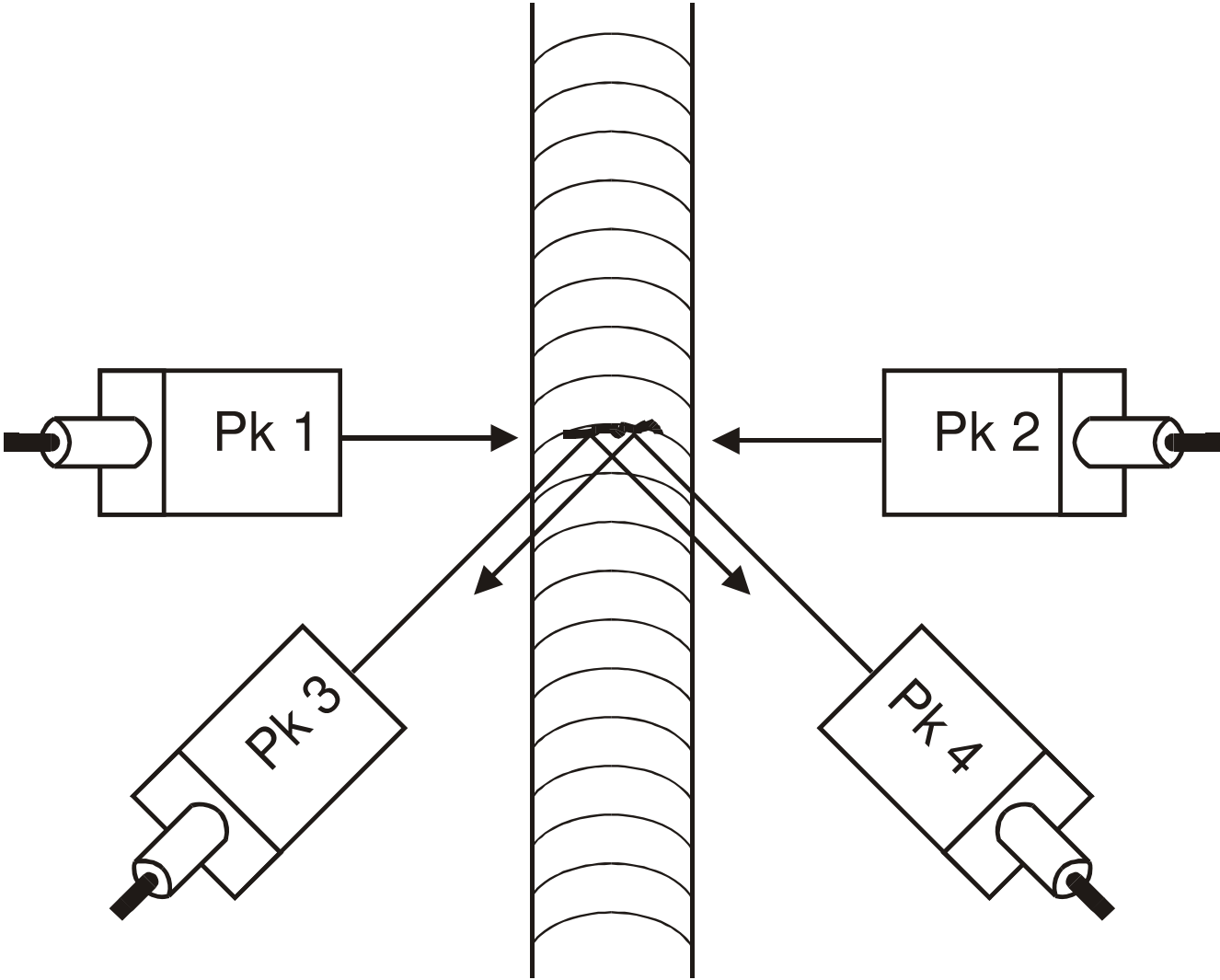
ZfP im Produktions-Ablauf *NDT within Production Process*



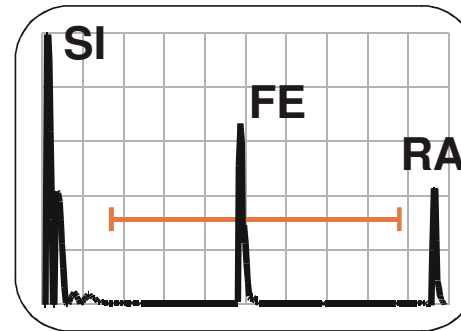
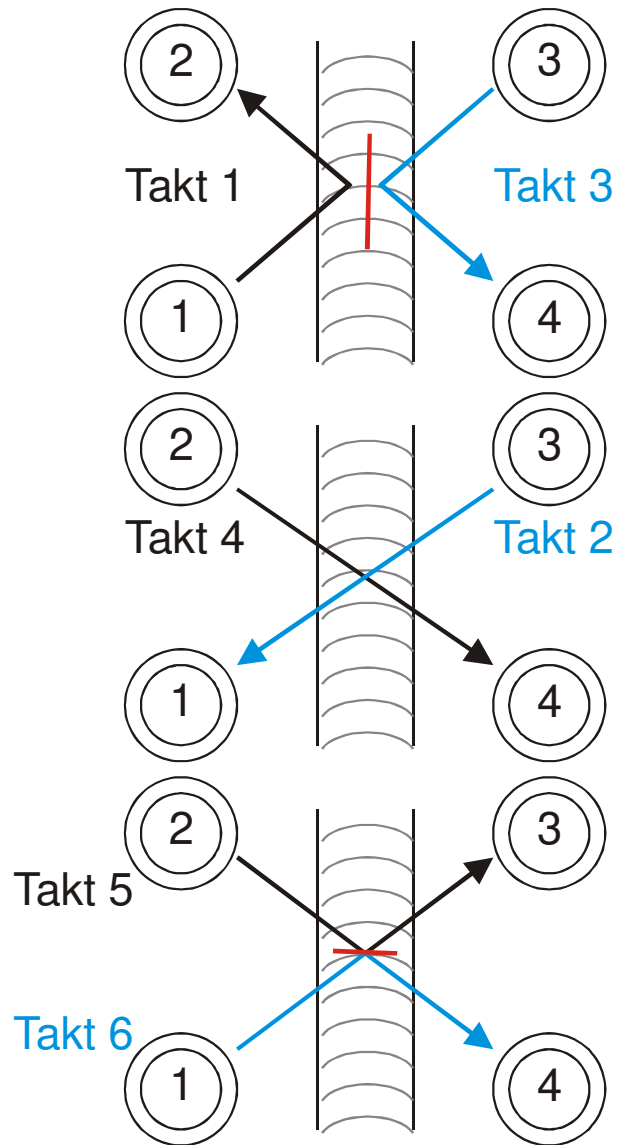
Schweißnahtprüfung *Weld Inspection*



Längsfehler-Prüfung *Longitudinal Flaw Detection*

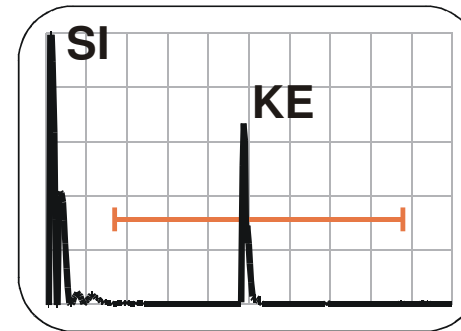


K-Anordnung *K-Configuration*



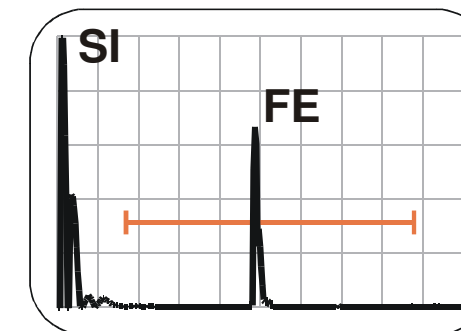
Längsfehler

SI = Sendepuls
FE = Fehlerecho
RA = Raupeanzeige



Koppelkontrolle

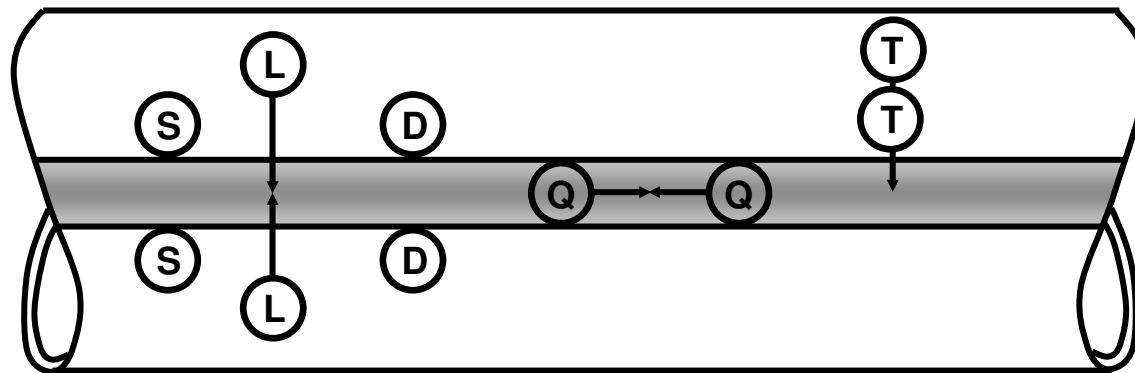
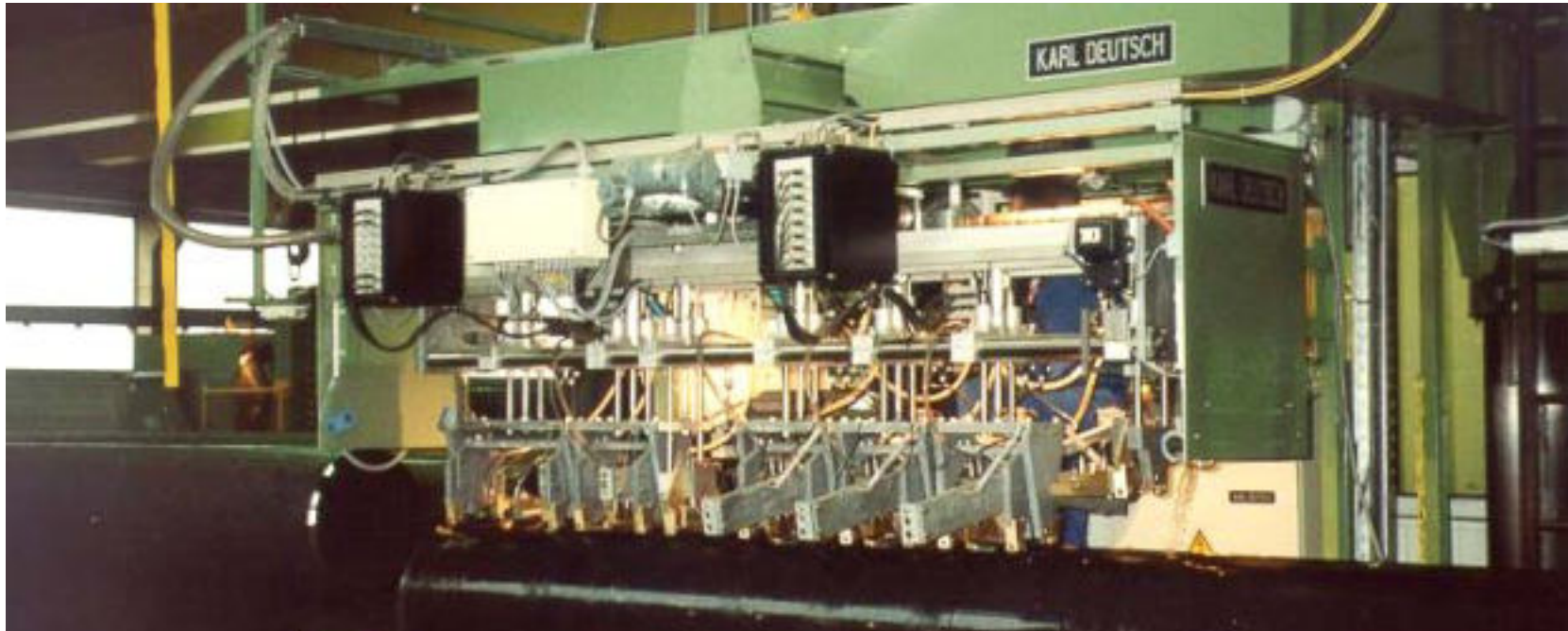
SI = Sendepuls
KE = Koppelecho



Querfehler

SI = Sendepuls
FE = Fehlerecho

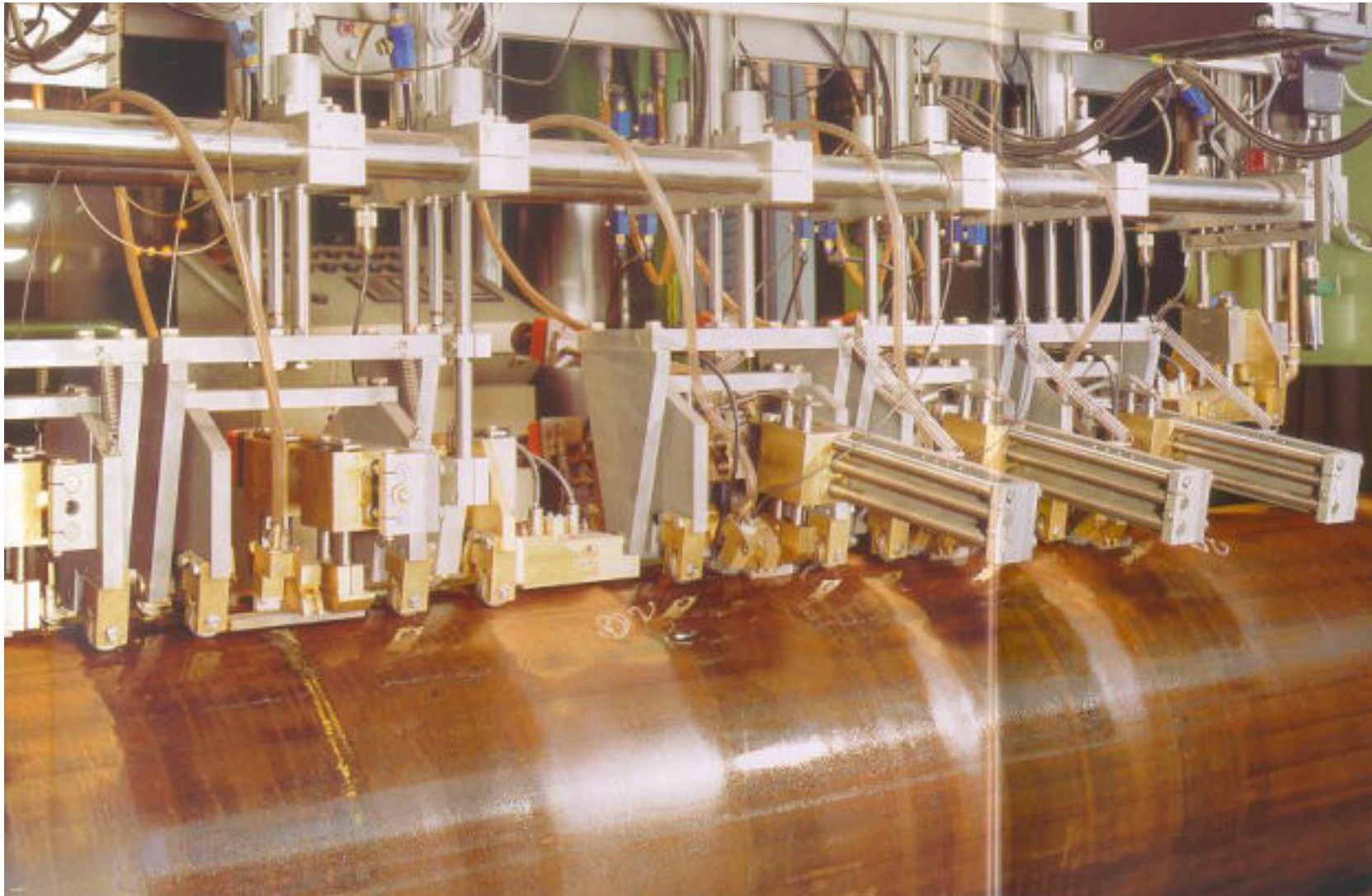
X-Anordnung *X-Configuration*



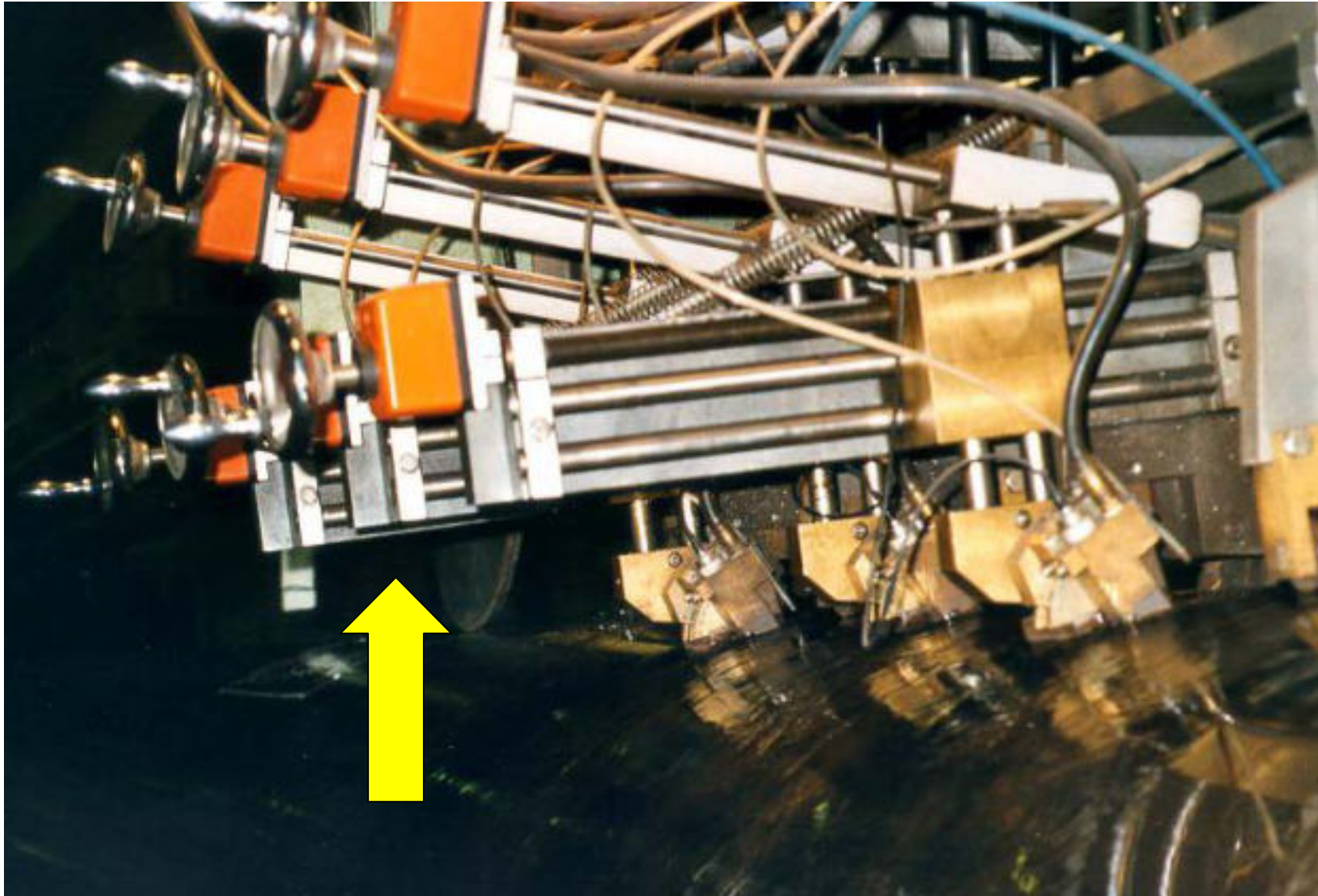
Beispiel
Example

2 x 2S
3 x 2L
1 x 2D
1 x 2Q
1 x T

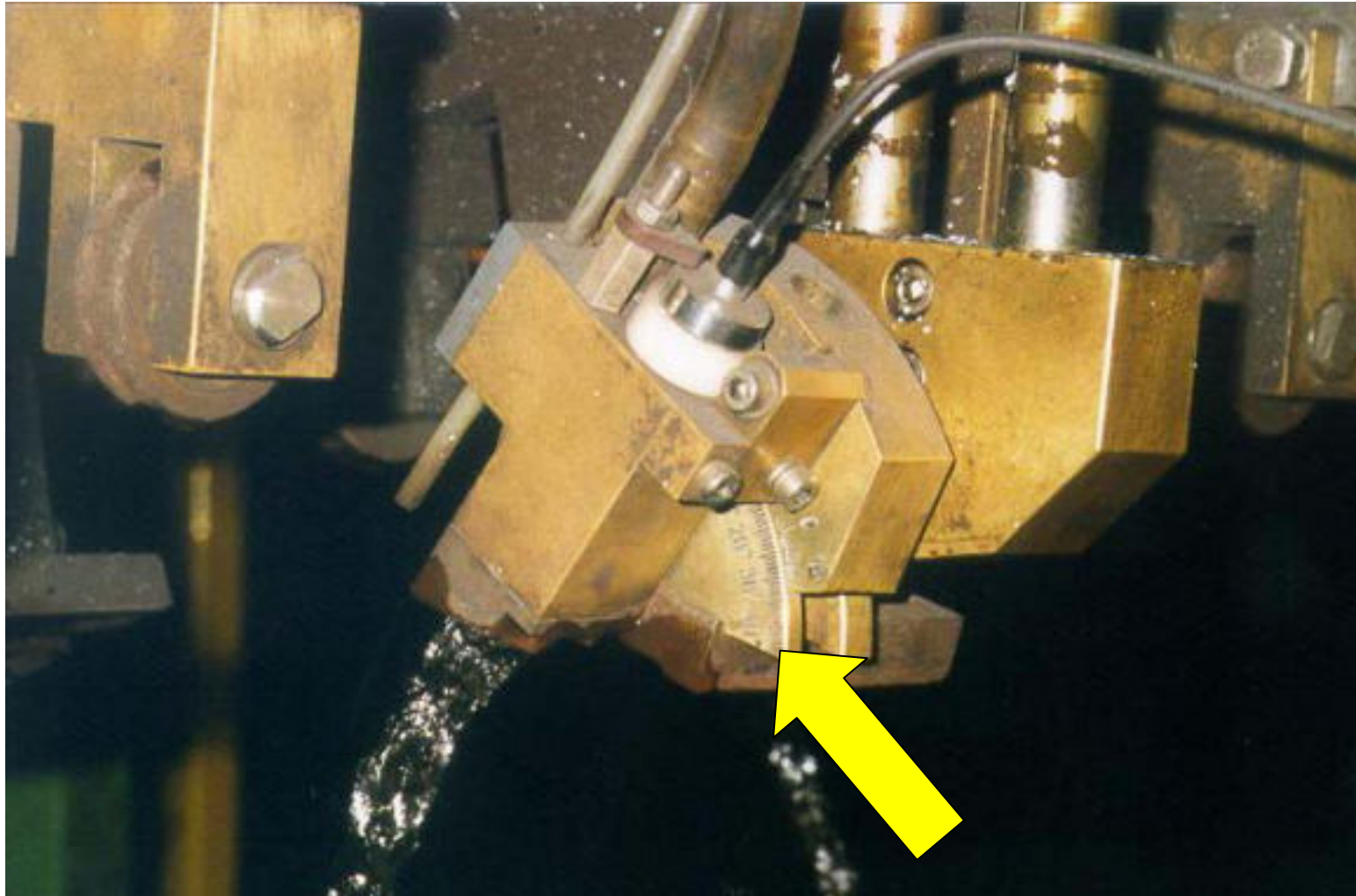
SNUL Prüfkopf-Anordnung *SNUL Probe Configuration*



SNUL Prüfkopfträger *SNUL Probe Carriers*



SNUL: Prüfkopf-Verstellung / *Probe Positioning*



SNUL: Einstellung Einschallwinkel / *Adjustment Incidence Angle*



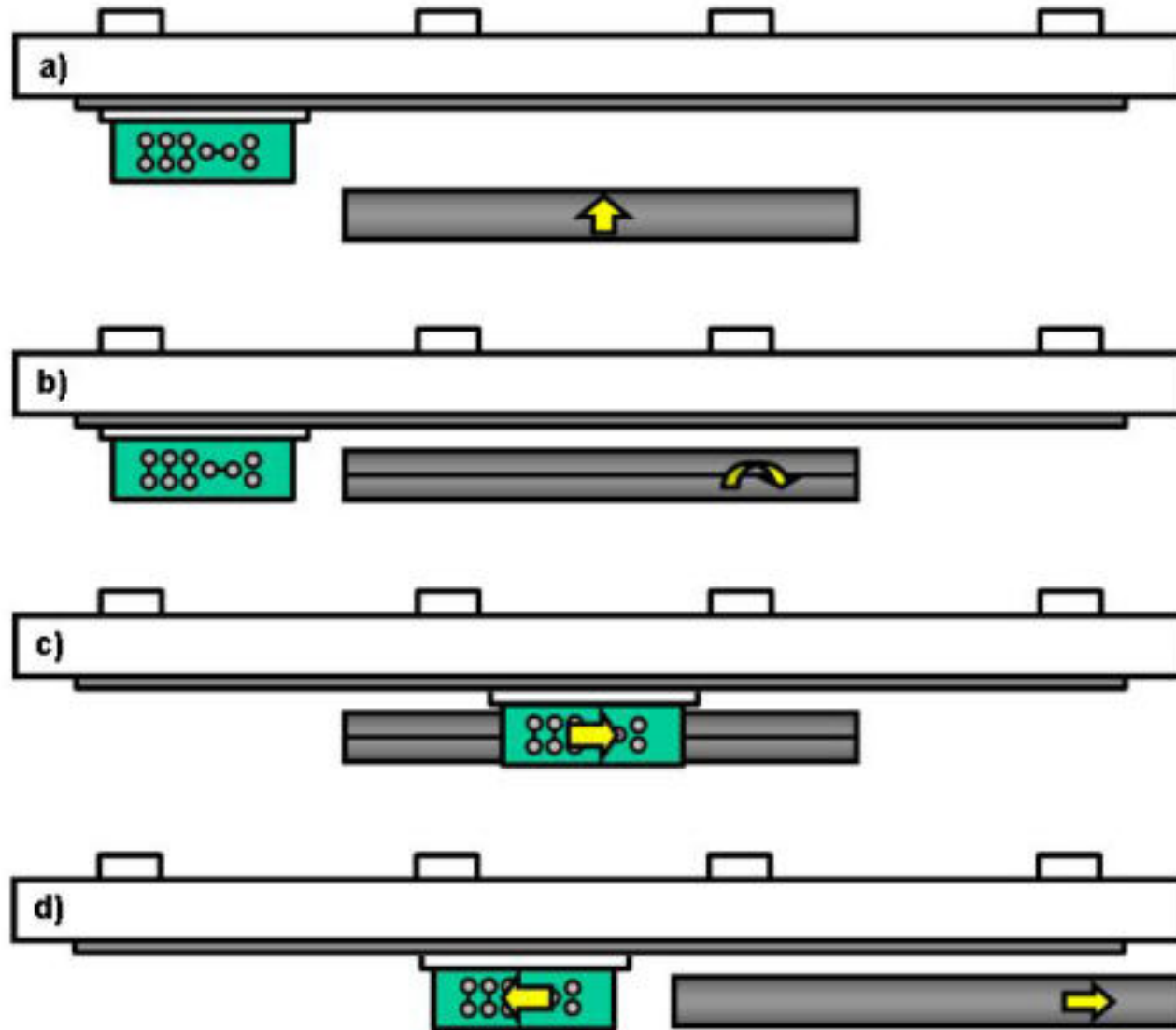
SNUL: Bedien-Plattform *Operator Platform*



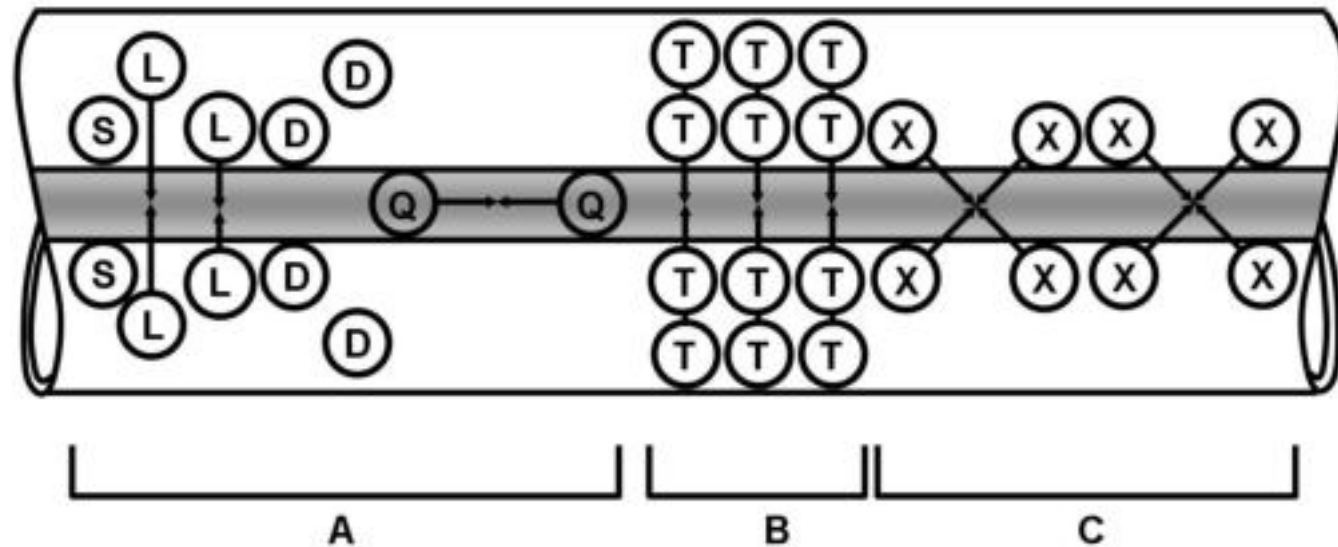
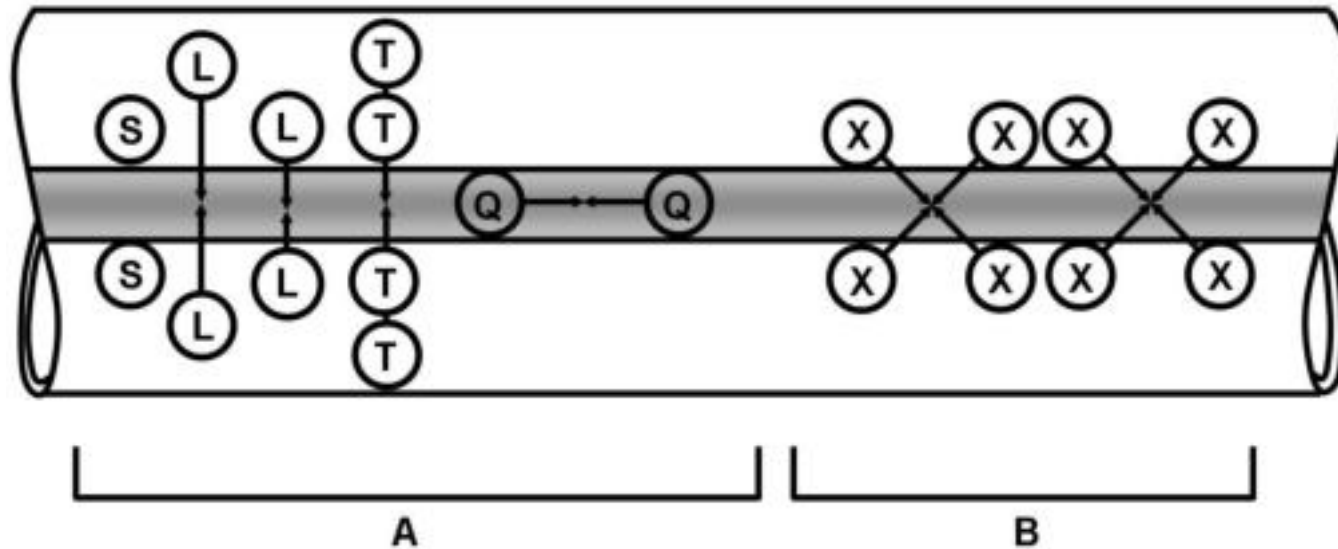
SNUL: Kalibration *System Calibration*



SNUL: Kamera & Monitor (Nahtfolger) *Camera & Screen (Seam Tracking)*



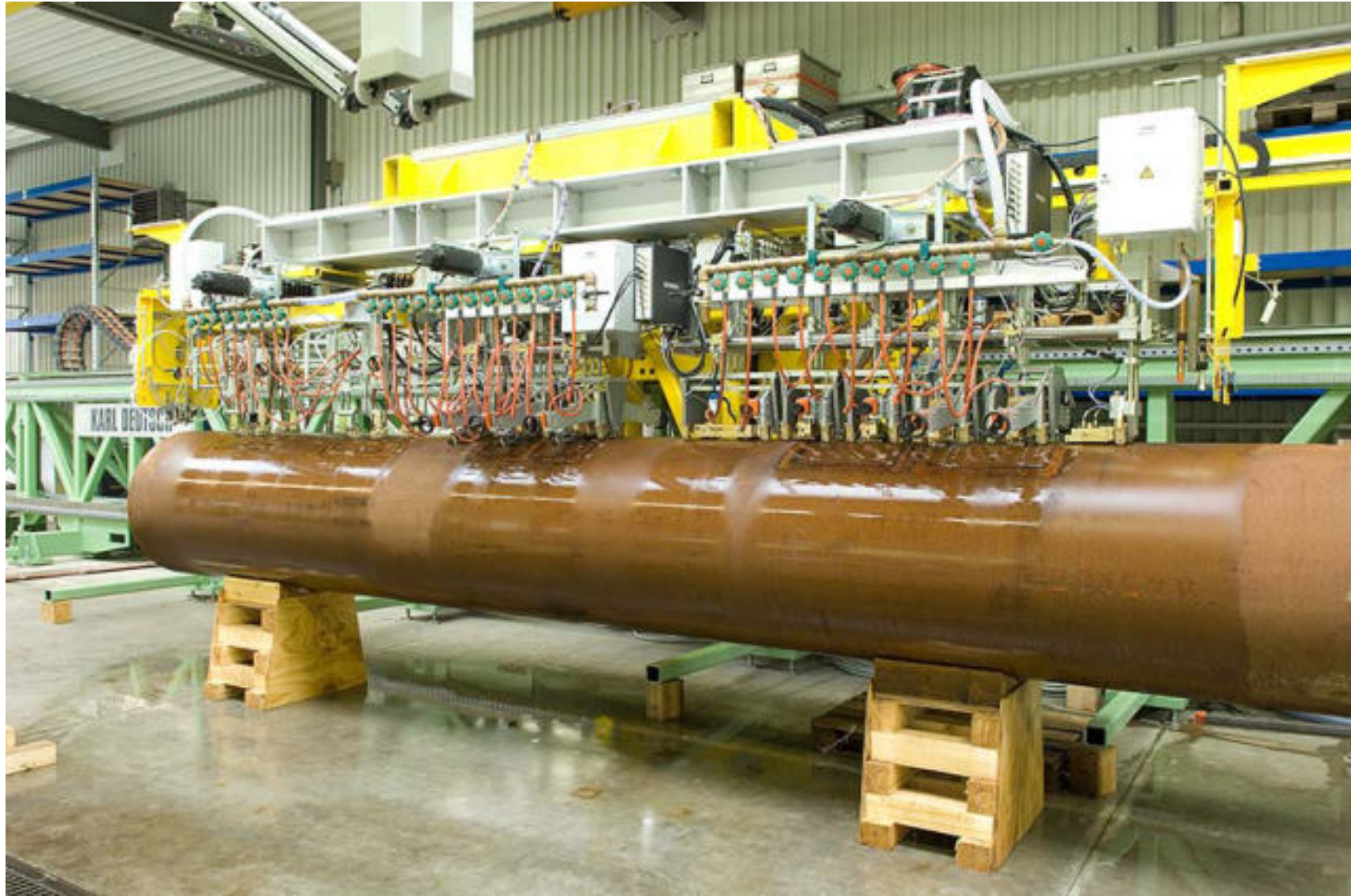
SNUL-Portal: Prinzip Rohrtransport *Principle Pipe Transport*



SNUL-Portal: Prüfkopfanordnungen *Probe Configurations (Baosteel 2007)*



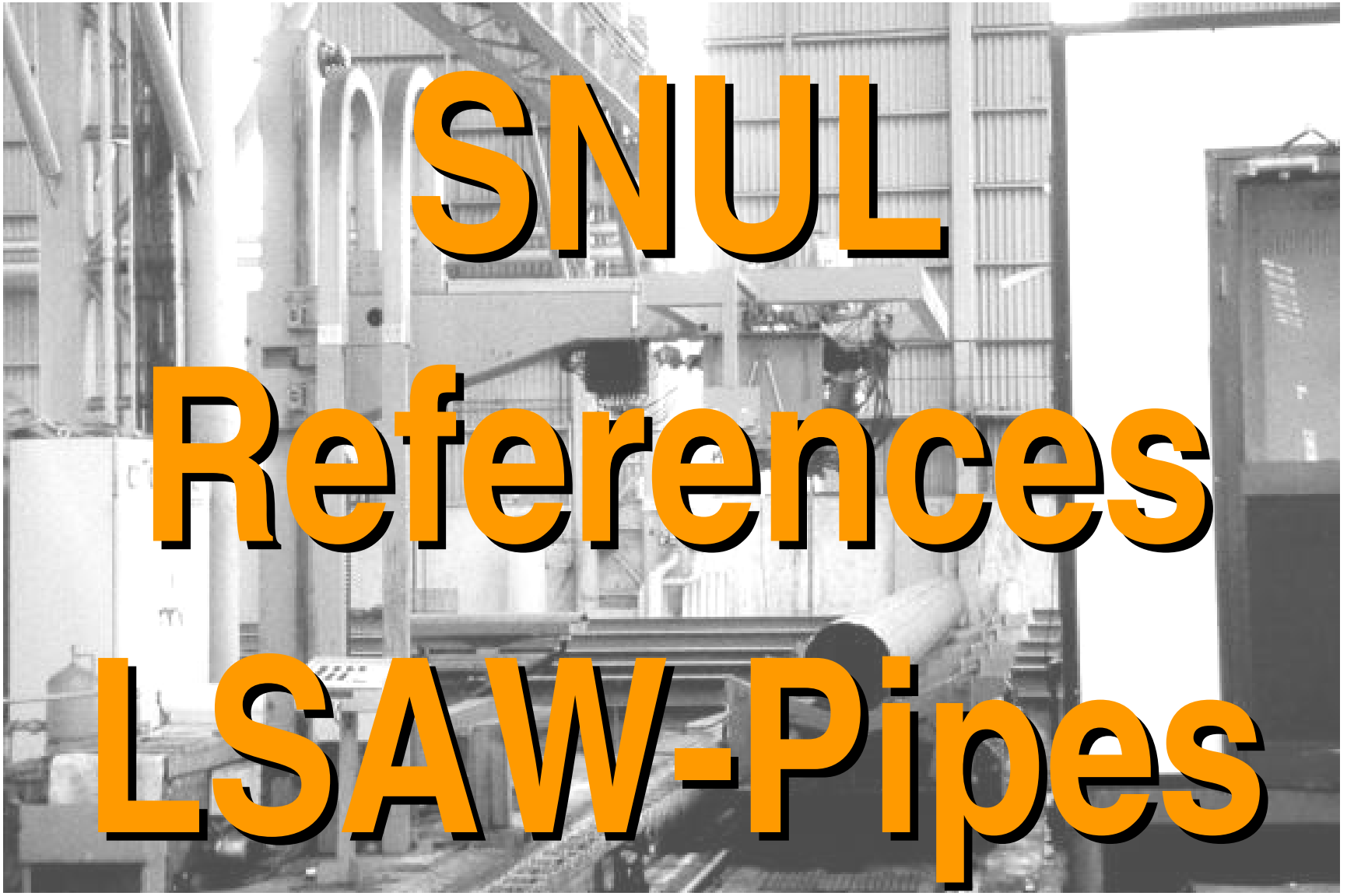
SNUL Prüfportal vor Expander *Testing Portal before Expansion*



SNUL Prüfportal nach Expander *Testing Portal after Expansion*



SNUL Höhenverstellung Prüfportal *Height Adjustment Testing Portal*



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References

LSAW-Pipes

(SNUL = Schweiß-Naht Unter-Pulver Längsnaht)

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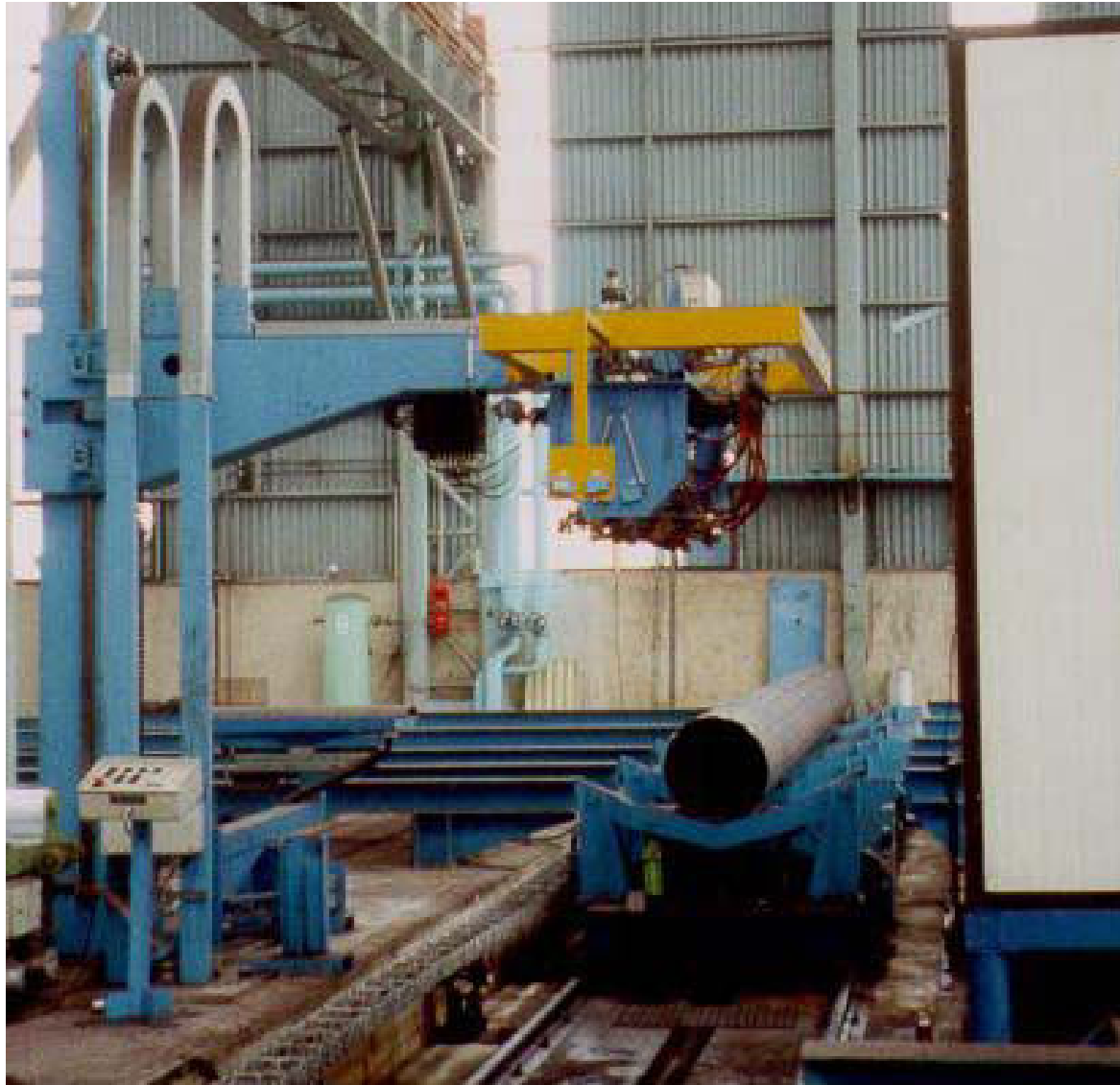
Echograph 1140

4L 2Q



Eisenbau Krämer (formely Westfalenwerk), Germany 1977

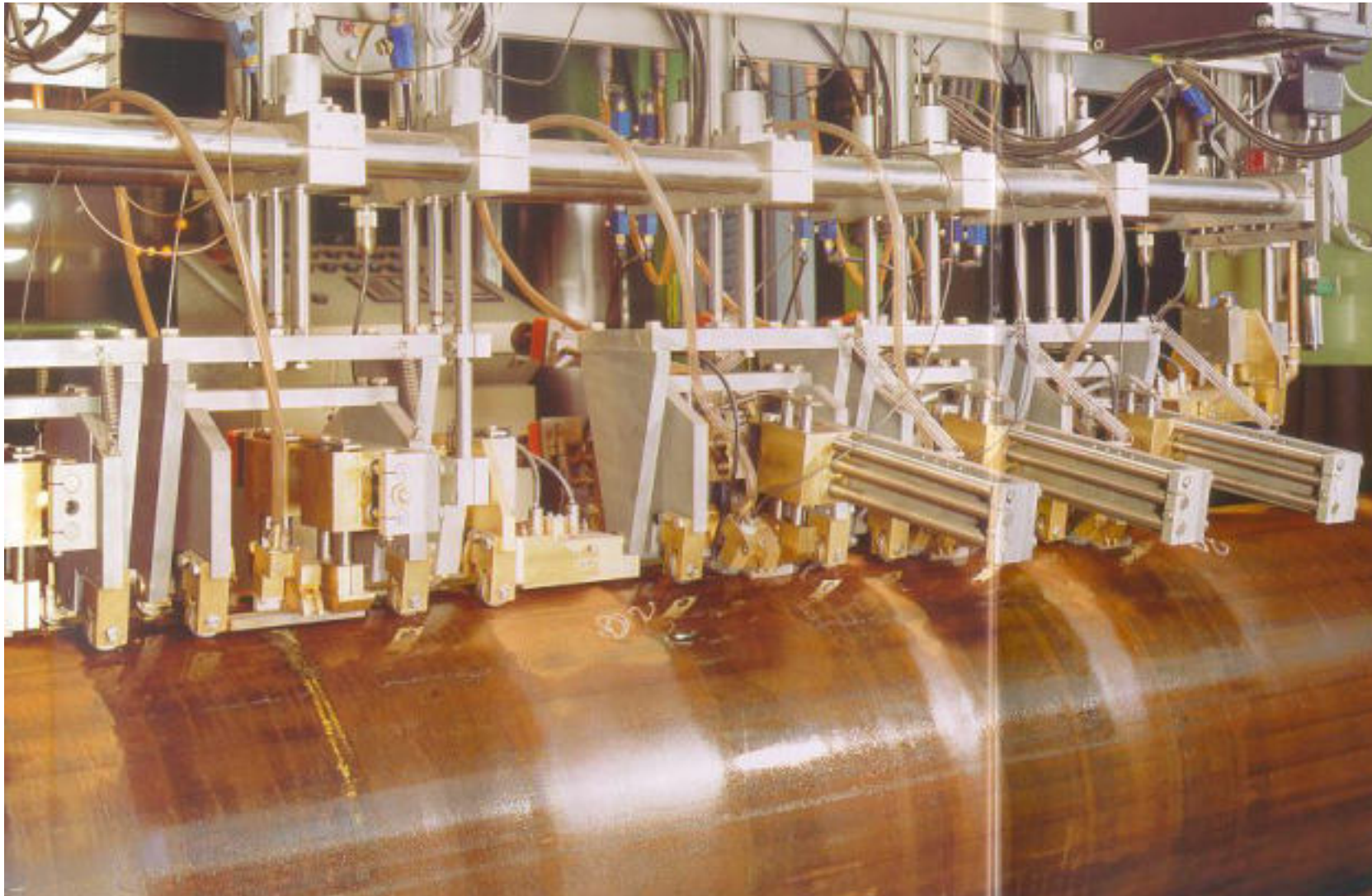
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Echograph 1150
4L 2Q 2DP
 $\text{Ø} = 400 - 1625 \text{ mm}$

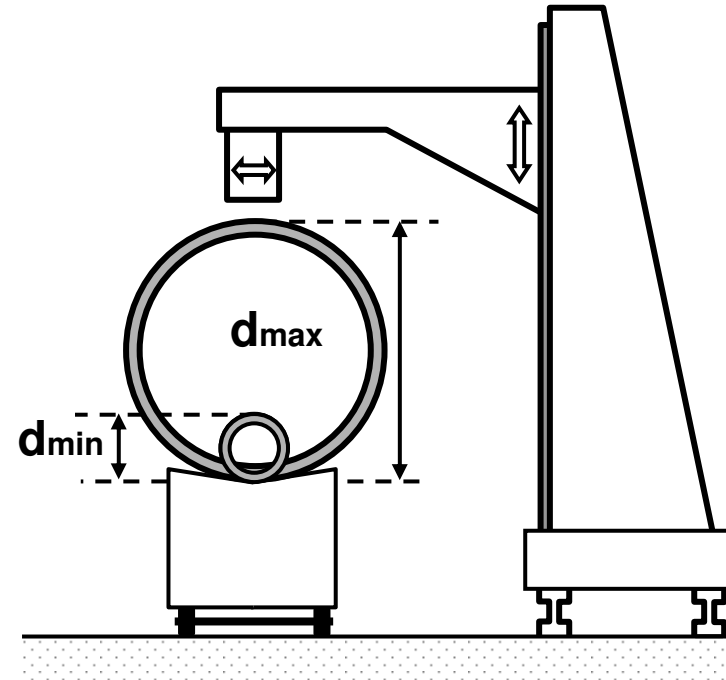
Seah Steel (formely Pusan Steel Pipe), Korea 1991

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Erndtebrücker Eisenwerke, 1994

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巨龙钢管有限公司

JULONG STEEL PIPE CO., LTD.

Ultrasonic Testing Equipment: This equipment is imported from Karl Deutsch in Germany, which is one of the most famous UT inspection equipment manufacturers in the world. This equipment has the characteristic of anti-disturbance and less inspection blind-area.

SNUL-E1150-4L2Q2DP (8 probes) @ Julong Steel Pipe, China 2001

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SNUL-Echograph-4L2Q2DP (8 probes) @ Erndtebrueck-Korea 2004

(SNUL-SNUS Overview forPC Feb02, p. 171)



SNUL-Echograph-6L2Q2DP (10 probes) @ Canadoil Thailand 2006

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SNUL-Echograph-6L2Q2DP (10 probes) @ Khartzysk Ukraine 2007



SNUL Prüfportal (2 Stk) *Testing Portal (2 systems)* @ BAOSTEEL 2007

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SNUL-Revamping @ EEW, 2007

(SNUL-SNUS Overview forPC Feb02, p. 175)

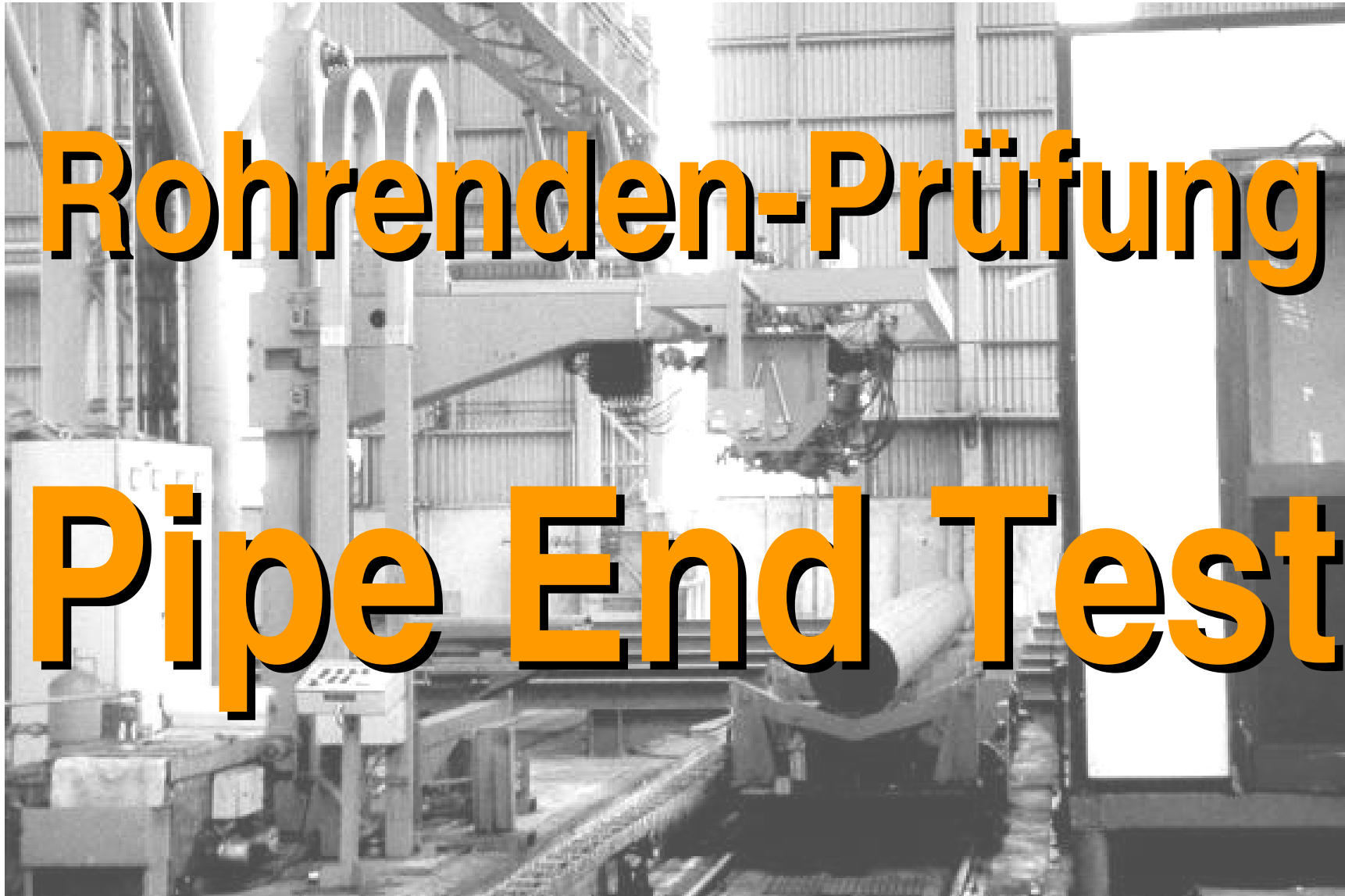
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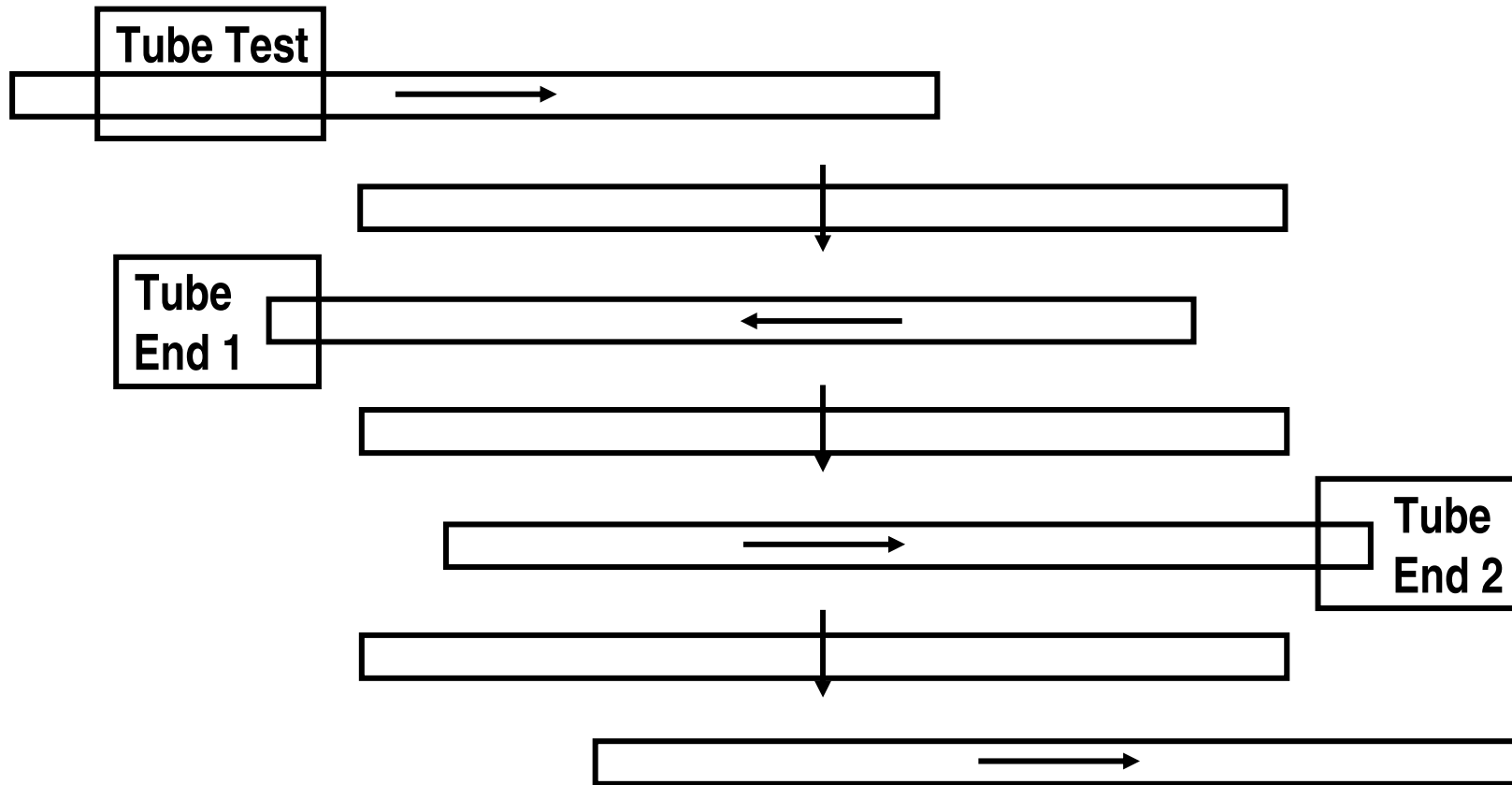


SNUL-1155 @ EEW, 2007

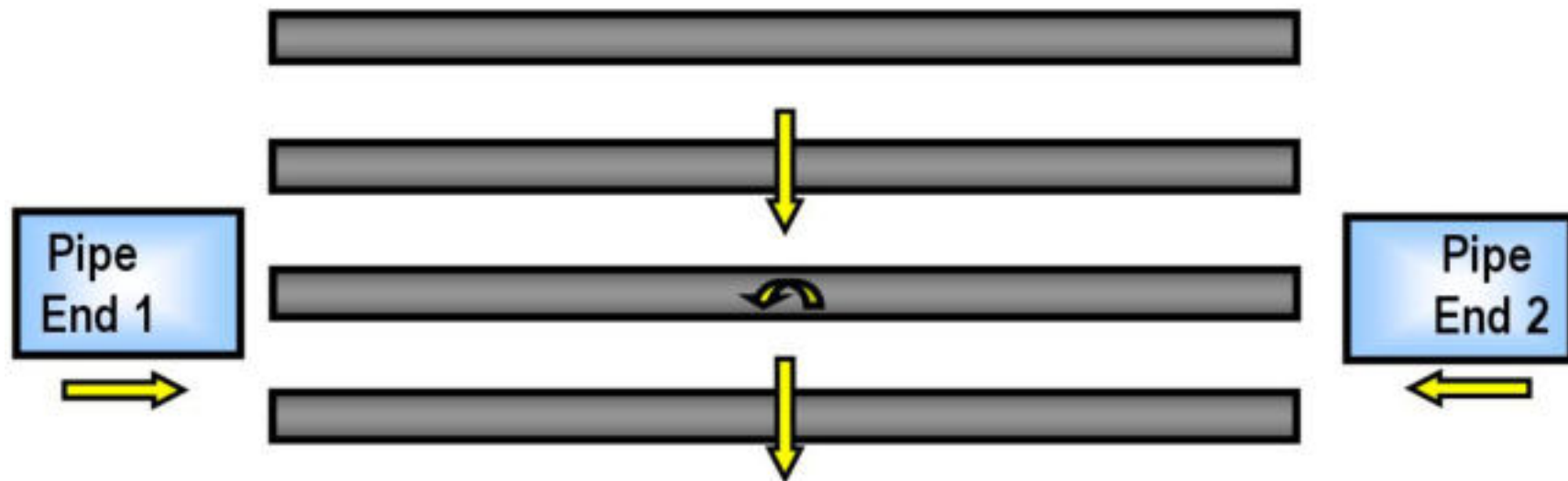
Rohrenden-Prüfung

Pipe End Test

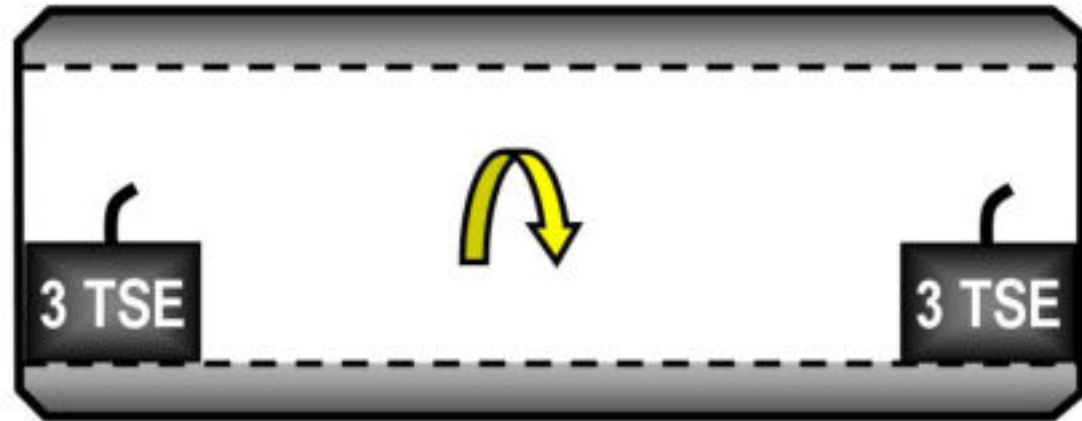




REPA: Prinzip Rohrtransport *REPA: Principle Tube Transport*



REPA: Prinzip Rohrtransport *REPA: Principle Tube Transport*



- Rohrenden-Prüfung, UP-Großrohre
- Prüfung von innen mit Rohr-Rotation
- pro Seite 50mm Prüfspur
- 6-Kanal-US-Elektronik (2 Stk 3TSE-PK)

- *LSAW-Pipe End Testing*
- *inspection from internal surface, pipe rotation*
- *50mm test trace on both ends*
- *6 channel UT electronic (2 pc 3TSE-probe)*

REPI-Echograph1155-2*3A: Rohrenden-Prüfung *Pipe End Test*

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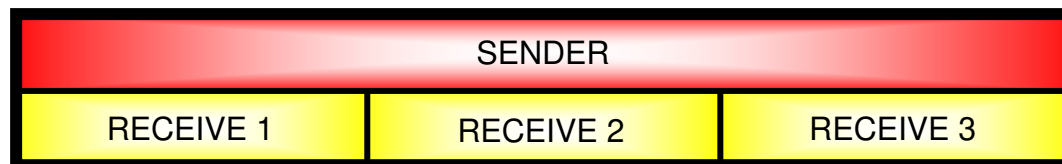


REPI-Echograph 155: Rohrenden-Prüfung *Pipe End Test*



REPI-Echograph1155: Prüfkopfhalter *Probe Holder*

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3 STSE 18.3/10 PB 5:

- SE-Prinzip (Spalt)
- 3 (oder 4) Empfänger
- gemeinsamer Sender
 - robustes Gehäuse
 - flache AVG-Kurve (gleichmäßig empfindlich)
- 5 MHz Composite

3 STSE 18.3/10 PB 5:

- *dual element principle*
 - *gap coupling*
 - *common transmitter*
 - *3 (or 4) receivers*
 - *robust housing*
 - *flat DGS curve*
- (even sensitivity over depth)
- *5 MHz composite*

Rohrenden-Prüfung (Prüfkopf) *LSAW-Pipe End Test (Probe)*

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- 3 Empfänger-Kanäle (Dopplungen)
 - 2 Kanäle pro Umfangsrichtung (Längsfehler, Impuls-Echo)
 - Prüfspur 50mm
 - Spaltankopplung, Rollenführung
- 3 receiving channels (laminations)
 - 2 channels, circumferential (longitudinal defects, pulse echo)
 - test trace 50mm
 - gap coupling, roller guidance

ANGLE 1

ANGLE 2

SENDER

RECEIVE 1

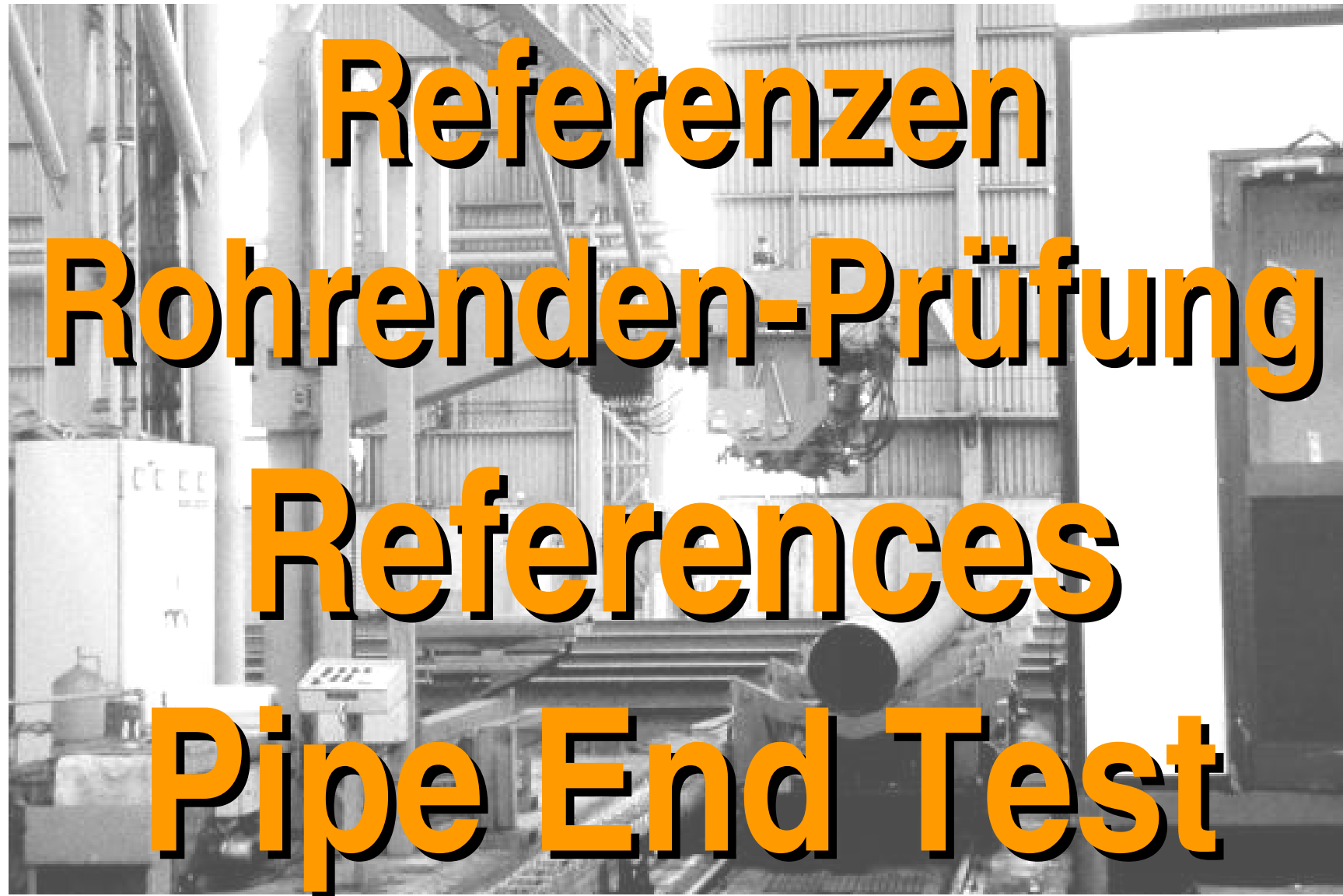
RECEIVE 2

RECEIVE 3

ANGLE 1

ANGLE 2

Rohrenden-Prüfung (2*7 Kanal) *LSAW-Pipe End (2*7 channels)*





REPI-Echograph: Rohrenden-Prüfung *LSAW-Pipe End Test* @ Europipe 2002



REPI-Echograph 1155: Rohrenden-Prüfung *Pipe End Test* @ Baosteel 2007





Impressionen aus dem Anlagenbau im Werk 2 ...

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Inbetriebnahme @ KD *Assembly @ KD*



Inbetriebnahme @ KD *Assembly @ KD*

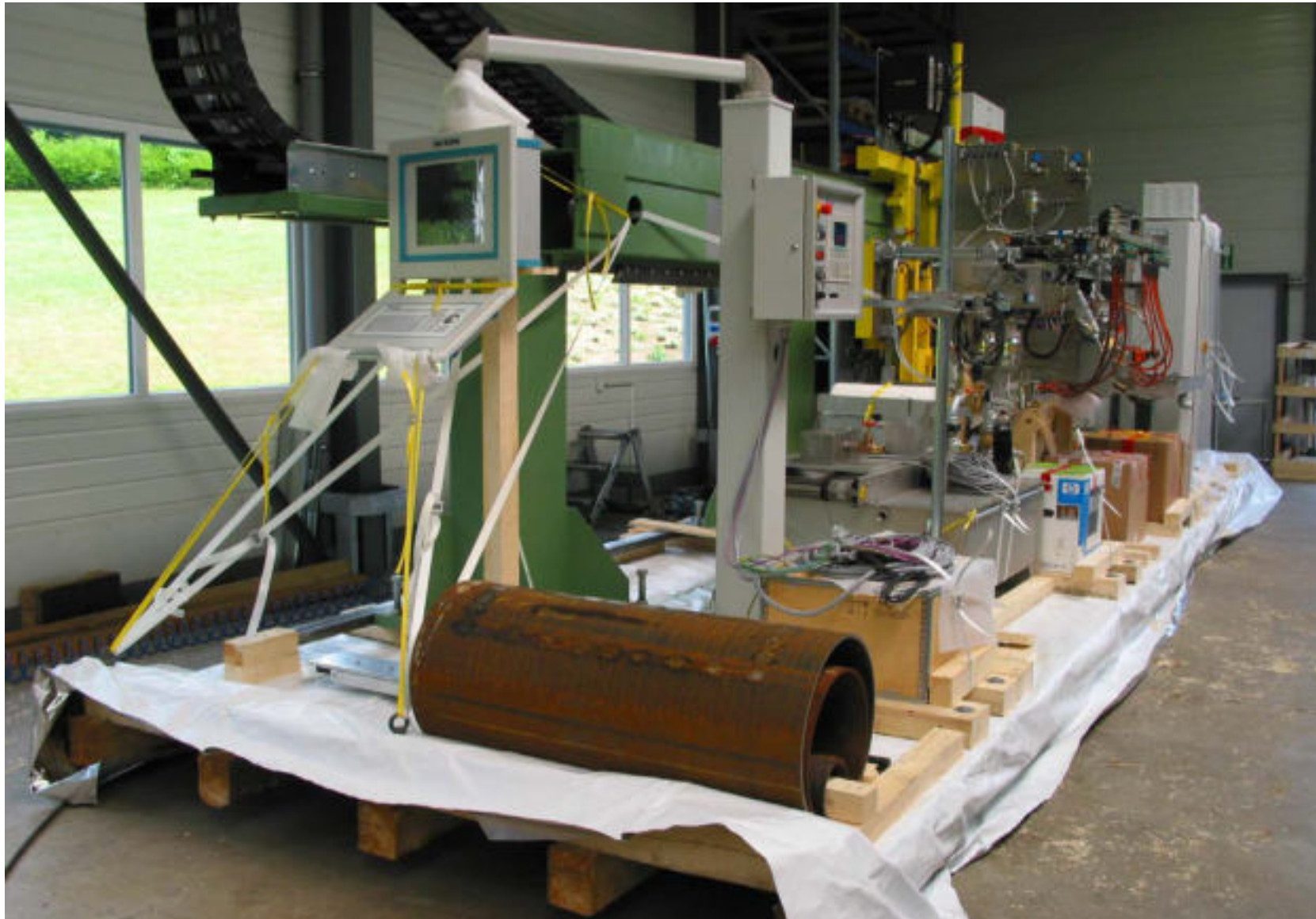
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Inbetriebnahme @ KD *Assembly @ KD*



Transport einer Bandprüfanlage



Verladung *Shipment*



Verladung *Shipment*

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- Spalt- & Strahlankopplung
- ECHOGRAPH Ultraschall-Elektronik
- Windows-Datenverwaltung
- Schweißnahtprüfung
 - a) Längsfehler
 - b) Querfehler
 - c) Dopplungen
- Rohrenden-Prüfung

- *gap & jet coupling*
- *ECHOGRAPH electronics*
- *Windows Data Management*
 - *weld testing*
 - a) *longitudinal defects*
 - b) *transverse defects*
 - c) *lamination test*
- *tube end inspection*



Zusammenfassung!
Conclusions



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www.KarlDeutsch.de