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Panoramic Pipe Weld Computed Radiographic Inspection System Facility

Computed Radiographic Inspection

12” to 48” OD pipeline

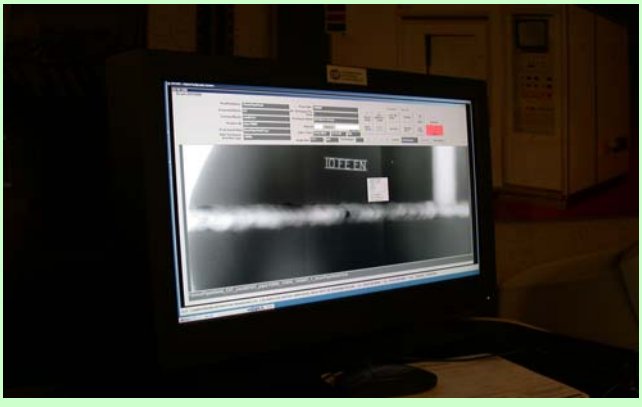
For normal and tie-in welds

(Replaces conventional film radiography with digital radiography)

For further details contact CIT on +44 (0) 1908 260082.

Executive Summary

This technical report introduces and details the deployment of Digital Computed Radiography Inspection Technology for one of your Cross-Country Pipeline construction projects. The key objective is to gain increased productivity in the form of higher throughput per shift and faster preparation of deliverables to your end customers, leading to an increased economic advantage over your competitors.



Objectives of Digital Computed Radiography Inspection system

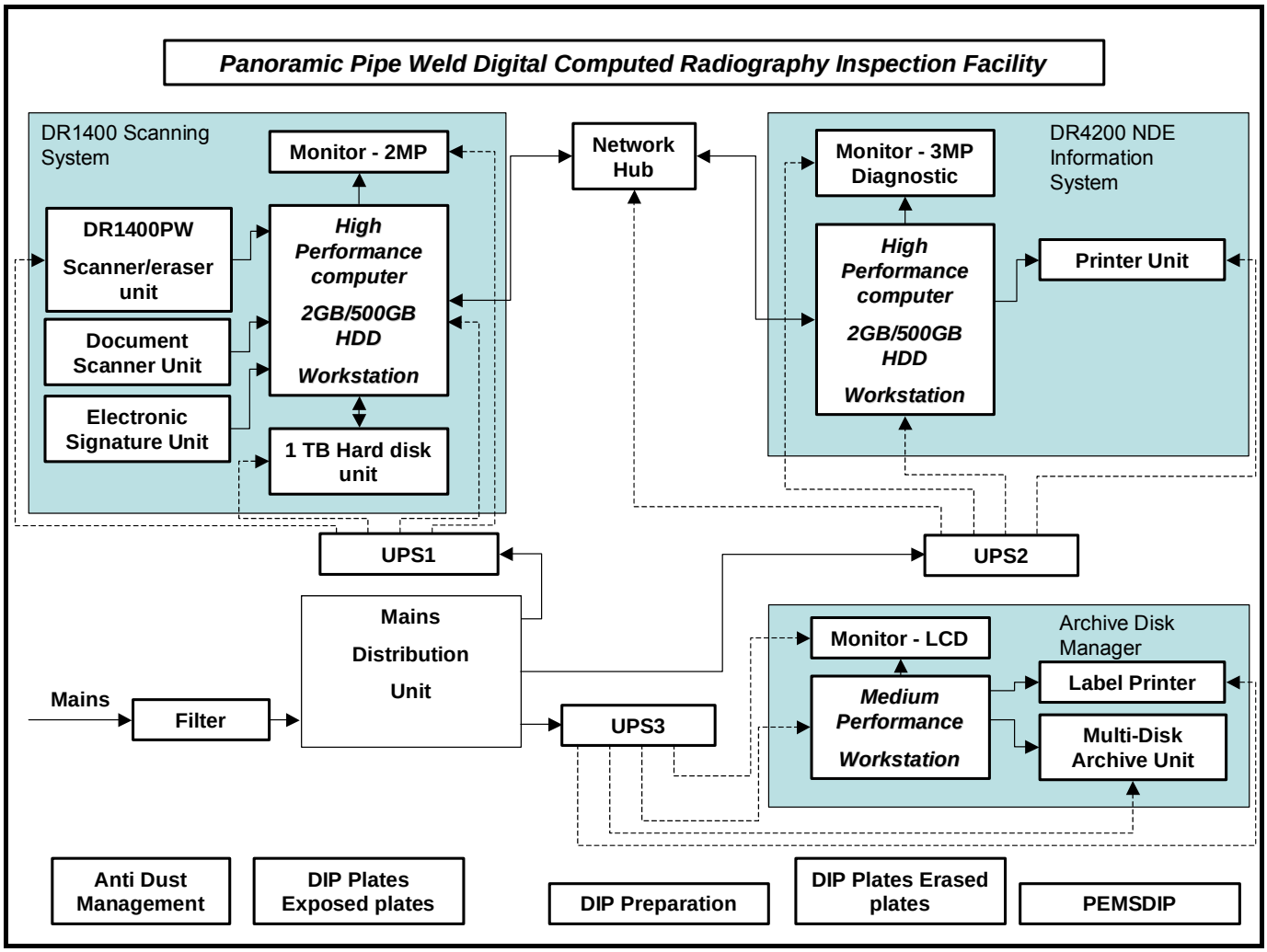
To enable NDT Radiography for pipeline circumferential welds to be carried out. This is for normal and tie-in pipeline welds.

Nominal Pipe Diameter	Circumference	Material thickness	Radiographic Technique	
			Normal	Tie-in
12 inch	1017 mm	5mm to 89mm	SWSI	DWSI
16 inch	1277 mm	5mm to 89mm	SWSI	DWSI
18 inch	1436 mm	5mm to 89mm	SWSI	DWSI
24 inch	1915 mm	5mm to 89mm	SWSI	DWSI
30 inch	2394 mm	5mm to 89mm	SWSI	DWSI
36 inch	2873 mm	5mm to 89mm	SWSI	DWSI
42 inch	3351 mm	5mm to 89mm	SWSI	DWSI
48 inch	3830 mm	5mm to 89mm	SWSI	DWSI
+ up-to 84”		5mm to 89mm	SWSI	DWSI

The delivered radiographic images are to be delivered on archive media, which has permanent, tamperproof electronic data and has 25-50 years data life. The information from archived radiograph data is to be retrieved with navigational software. The navigational software to provide advanced radiograph analysis and includes report generation.

Site Digital Computed Radiography Inspection facility

The block schematic of the above facility is provided



The Site computed digital radiography department will comprise of the following:

1. Radiographic source :

A. Gamma source Se75 or Ir192 with 1.5mm by 1.5mm focal spot
   1. Panoramic Gamma radiography crawler
   2. Gamma source site storage unit
   3. Mechanical jigs and fixtures
   4. Radiation barrier and radiation level monitoring equipment.
   5. Battery charging management and spare batteries
   6. Crawler position monitoring system

OR

B. X-ray source 300kV with 1.5 mm by 1.5mm focal spot or CP160kVCP 78R X-ray generator unit for tie-in weld inspection
   1. Panoramic X-ray radiography crawler
   2. X-ray source site storage area
   3. Mechanical jigs and fixtures
   4. Radiation barrier and radiation level monitoring equipment.
   5. Battery charging management and spare batteries
   6. Crawler position monitoring system
   7. 160kV directional X-ray unit for tie in welds inspection including radiation warning system and
   8. Associated Mains supply / Generators

2. CIT/DR1400 Digital Computed Radiography system facility

A System

1 DR 1400 Pipeweld software version 1.6.6
2 Digital Radiography storage archive management system architecture
3 Digital Radiography data in accordance with CEN 138NDE data format AHG
4 DR1400 PW high definition /wide dynamic range 16 bit 12.5 micron resolution scanner unit
5 High performance computer with min. 2GB memory and 500 GB HDD and backup
6 Diagnostic quality radiograph display monitor 3MP or 5 MP
7 Mechanical adapters for long imaging plate handling
8 Document scanning system integrated with system application
9 High intensity Erasure unit
10 CR Phantom for l;ong-term qualification of Digital Computed Radiography system
11 Duplex IQI in accordance with EN 462.5
12 IQI and lead numbering tapes for different pipe diameters
13 Anti dust / sand / weather ingress protection system
14 Radiograph ID lead numbers or alternative facility.
15 UPS power supply unit
16 Printer unit and paper
17 Mains distribution units
18 **CIT/DR1400 Archive Disk manager unit**
19 Media label printer unit
20 Archive disk computer unit
21 Multi drive rack unit for simultaneous writing of multiple archive media
22 Tamperproof archive disk labels
23 CIT/DR4200 NDE centralised radiograph retrieval integrated system
24 CIT/DR4200 1.6.6. NDE retrieval analysis system software integration application

B Consumables

1 Flexible Imaging plates with jackets and protectors **(to suit the production requirements)**
2 DVD 9.4 RAM media (or UDO Optical media)
3 PEMSDIP Plates for different OD Pipes
4 2” wide adhesive tape for fixing to pipe
5 Heavy Duty Microfibre cleaning cloth and imaging plate cleaning solution
6 DR scanner cleansing sheets
7 Data archive media (DVD-RAM / UDO).
8 DIP Imaging plate poly sealing bag unit
9 Spares fuses, lamps

3 Human Resources (crew minimum)

The operators will be trained by CIT for the operation of digital radiography system in the field environment.

1 Radiograph operators who carry out exposures (two) Level I or II
2 Digital radiography scan operator- Level I or II, must be computer literate
3 Supervisor /system administrator (part time) – Computer Literate
4 System maintenance engineer - computer engineer
5 Inspector/consultant – Level III - could be end customer, sub-contracted or in-house

4 Portakabin or office space with electric and operative facilities (customer to provide)

1 Storage area for unexposed DIPs
2 Storage area for exposed DIPs
3 Secure digital archive media storage facility
4 DR1400 system scanning area
5 DIP preparation area
6 Crawler/X-ray unit storage or management area (separate cabin is suggested)
7 Anti-dust /sand/weather management area
8 Temperature control/Air conditioning unit
9 Subdued non-fluorescent light in scanning / diagnostic areas.
10 Sealed windows and sliding door 'airlock' to avoid ingress of dust
11 Mains Supply – 110/230V ac 50/60 Hz with line filtration
12 UPS with battery time of at least 60 minutes for each computer system

5 Other Requirements

1 Inspection procedure documents/Technique/Method statement
2 Ionisation/local H & S regulation in place

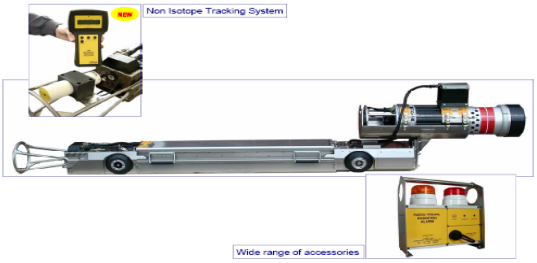
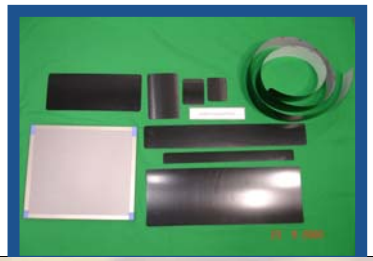
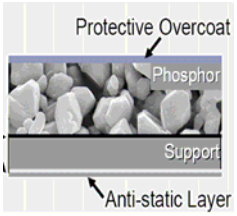
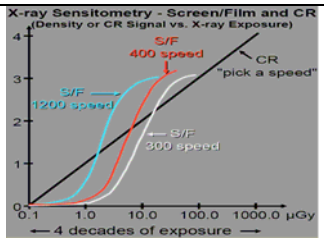
Customer Acceptance standards and international codes compliance

1. ASME V Article II on digitised radiograph films
2. ASME V Article VIII on phosphor imaging retrieval of digital radiographs
3. NUREG 1452 radiograph digitisation retrieval
4. Nuclear NAS 160/AES 6001/BS2633, CEN 1435
5. CEN 472/473 radiographic training system requirements
6. API1104 ASNT and ASTM 7002, 2033, 7020 technical working and practice inspection data retrieval

Note:

1. Timing calculations do not include the set-up & exposure time. Scanning can be done concurrently with exposure by having more sets of DIPs to increase throughput.
2. The radiographic quality will meet with the stipulated radiographic standards
3. Interpretation and archiving can take place at the same time as exposure.
4. Preparation of the deliverables will require writing of the disks only unless otherwise stipulated by the contract
5. The end customers will be required to be provided with one of the following:
   a. CIT/Digital Radiography viewer package as navigation software
   b. CIT/DR4200 NDE radiograph retrieval software package
   c. Complete workstation with DR4200 software package

Technical Specifications of the Digital Computed Radiography system

Radiographic sources **X-ray generator** **200kV X-ray crawler unit**	. 
OR **Gamma isotope**	 Se75 or Ir192 portable panoramic or directional gamma source with 1 mm focal spot. source head 69mm X 220mm length. Completed unit with various safety warning and auto timer controls
Computed radiography phosphor flexible reusable imaging plates (available in different sizes to suit all NDT inspection requirements) 	  Construction of the computed radiography imaging plates. The characteristics curves, which are depicted above, illustrate that the dynamic range is wider than films thus eliminating the dual film loading requirement
	Ultra high resolution scanning unit with 16 bit data with linearised behaviour, coupled with high performance computer processing and archive system to meet long term storage requirements. Fault tolerant systems that can sustain the data with complete NDE information management solutions to be parallel to the existing working practice. CIT/DR1400PW Digital Radiography v1.6.6 software package
 **Radiographic display** **Monitors**	High brightness (minimum 650 cd/m^2) diagnostic quality monochrome monitors with pixel pitch of 120 or 165 microns, allowing inspectors to report directly from the screen image. Monitors come with calibration software to ensure consistent viewing results between shifts and/or different work stations.
Environmental conditions	Ambient Temperature - 50º C to 55º C Product temperature - 50º C to 40º C Product temp. With protector +200º C

System Performance

Pipe Diameters and theoretical scan times – single scanning system

Pipe Diam.	Pipe Circum.	No.of DIPs per Weld	Longest DIP Length	Scan Time per batch of DIPs (up to 3)			Authorisation time per batch (secs)	Batches per hour			Batches per shift (12 hour) Continuous Operation		
				(100µm)	(60µm)	(30µm)		(100µm)	(60µm)	(30µm)	(100µm)	(60µm)	(30µm)
12 inch	1017 mm	3	430	195	324	649	60	11.44	8.11	4.68	137	97	56
16 inch	1277 mm	3	500	227	377	755	60	10.39	7.25	4.12	124	87	49
18 inch	1436 mm	3	500	227	377	755	60	10.39	7.25	4.12	124	87	49
24 inch	1915 mm	4	500	151	251	503	60	14.94	5.28	3.04	179	63	36
30 inch	2394 mm	5	500	227	377	755	60	10.39	3.63	2.06	124	43	24
36 inch	2873 mm	4	750	227	377	755	60	11.37	3.86	2.13	136	46	25
42 inch	3351 mm	5	750	340	565	1132	60	7.83	2.63	1.44	93	31	17
48 inch	3830 mm	6	750	340	565	1132	60	7.83	2.63	1.44	93	31	17

Pipe Diameters and theoretical scan times – twin scanning systems

Pipe Diam.	Pipe Circum.	No.of DIPs per Weld	Longest DIP Length	Scan Time per batch of DIPs (up to 3)			Authorisation time per batch (secs)	Batches per hour			Batches per shift (12 hour) Continuous Operation		
				(100µm)	(60µm)	(30µm)		(100µm)	(60µm)	(30µm)	(100µm)	(60µm)	(30µm)
12 inch	1017 mm	3	430	195	324	649	60	22.87	16.22	9.36	274	194	112
16 inch	1277 mm	3	500	227	377	755	60	20.78	14.50	8.23	248	174	98
18 inch	1436 mm	3	500	227	377	755	60	20.78	14.50	8.23	248	174	98
24 inch	1915 mm	4	500	151	251	503	60	29.88	10.56	6.07	358	126	72
30 inch	2394 mm	5	500	227	377	755	60	20.78	7.25	4.12	248	86	48
36 inch	2873 mm	4	750	227	377	755	60	22.75	7.72	4.26	272	92	50
42 inch	3351 mm	5	750	340	565	1132	60	15.66	5.26	2.88	186	62	34
48 inch	3830 mm	6	750	340	565	1132	60	15.66	5.26	2.88	186	62	34

Assumptions for above tables

(1) DIPs 70 or 100 mm width
(2) 20 seconds per image average authorisation time
(3) DIPs started at 30 second intervals
(4) 30 seconds to remove last batch at end of authorisation
(5) No allowances made for exposure times.

DWSI for Tie-in welds

(based on BS EN 1435 Annex A Fig A.2)

Pipe Diam.	DWSI with SFD = D	Max. Diag. length of plate (Circ/5)	+min. tape overlap (30 / 60mm)	CIT Recommended DIP	Number of plates
12 inch	1017 mm	203 mm	233 mm	240 mm	5
16 inch	1277 mm	255 mm	285 mm	300 mm	5
18 inch	1436 mm	287 mm	317 mm	350 mm	5
24 inch	1915 mm	383 mm	413 mm	430 mm	5
30 inch	2394 mm	479 mm	539 mm	500 mm	5
36 inch	2873 mm	575 mm	635 mm	500 mm	6
42 inch	3351 mm	670 mm	730 mm	750 mm	5
48 inch	3830 mm	766 mm	826 mm	750 mm	6

(1) Number tapes with 2cm spacing easily available up to 2m length, 5cm spacing assumed thereafter.

For further details contact sales at Computerised Information Technology Limited on +44 1908 260082 or email info@cituk.com