

INTERNATIONAL CAVITATION EROSION TEST

Test Rig Identification Card

Facility: cavitation tunnel

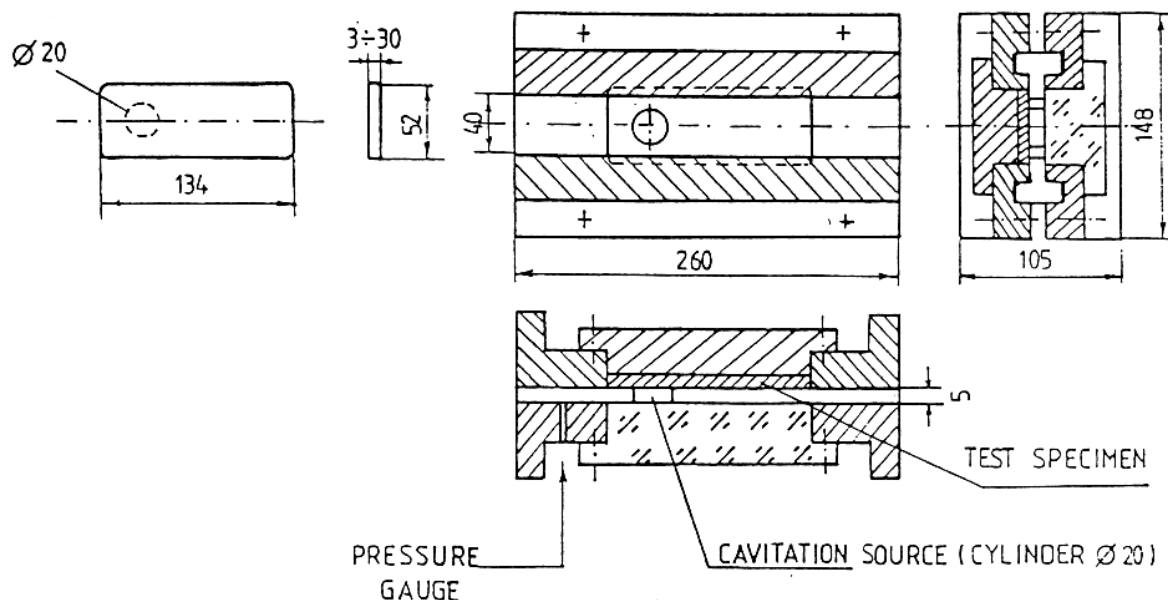
Cavitation is generated by means of:

cavitator /~~venturi~~/ cylindrical bolt

Laboratory: Institute of Water Problems
of the Bulgarian Academy of Sciences

1. Sketch of the cavitation chamber with specimens and basic dimensions (streamwise and transverse sections), dimensions and installation sites of the cavitator, specimen, pressure taps etc.

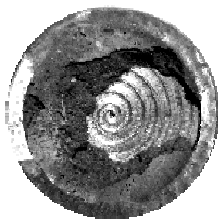
M 1:5



2. Basic operational data

pump power	55	kW
liquid velocity in the undisturbed flow	22,50	m/s
liquid pressure in the undisturbed flow (gauge)	1260,00	kPa
liquid velocity at the specimen surface	45,00	m/s
liquid pressure at the specimen surface (gauge)	480,00	kPa
standard temperature of liquid	15 - 17	°C
other data		

designer/manufacturer: Institute of Water Problems
of the Bulgarian Academy of Sciences
Sofia, Bulgaria



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Laboratory Results Summarisation

Laboratory: **INSTITUTE OF WATER PROBLEMS
OF THE BULGARIAN ACADEMY OF SCIENCES**
SOFIA, Bulgaria

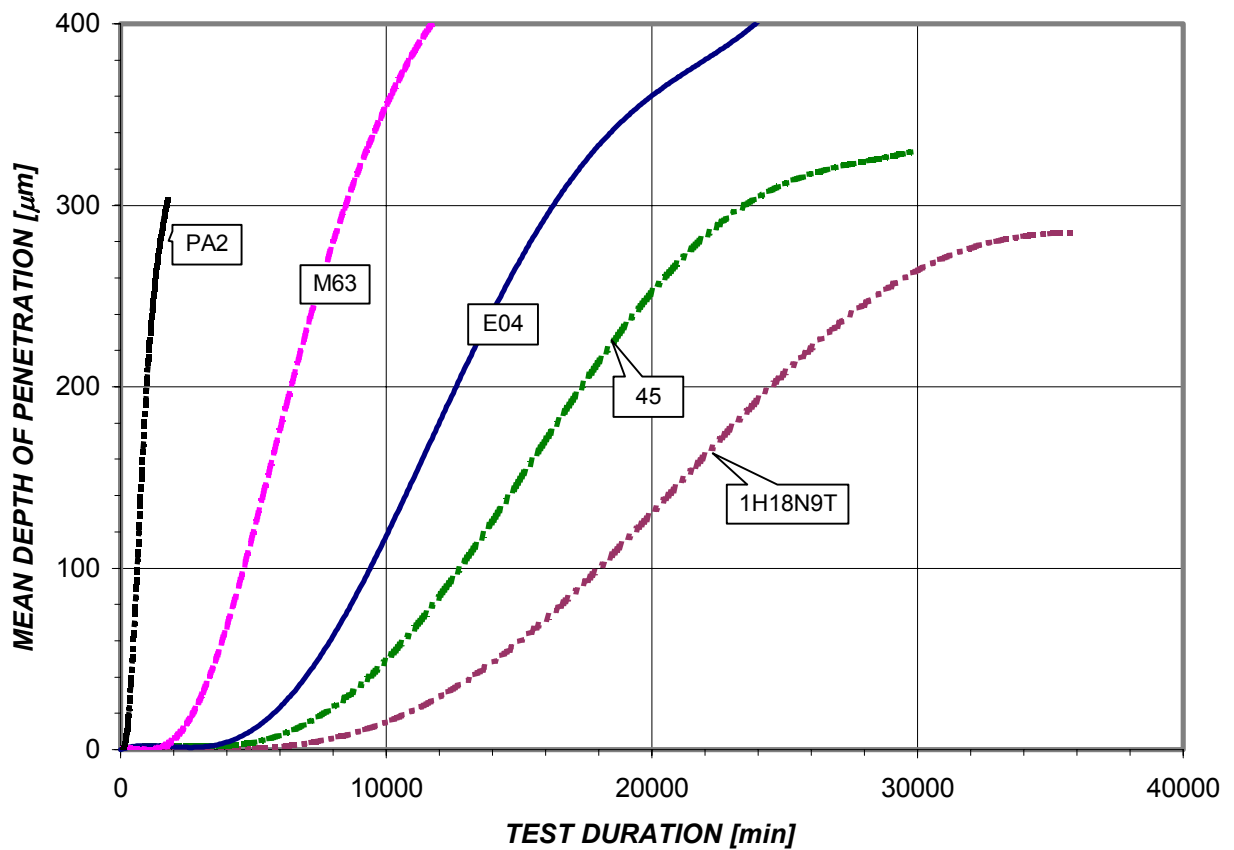
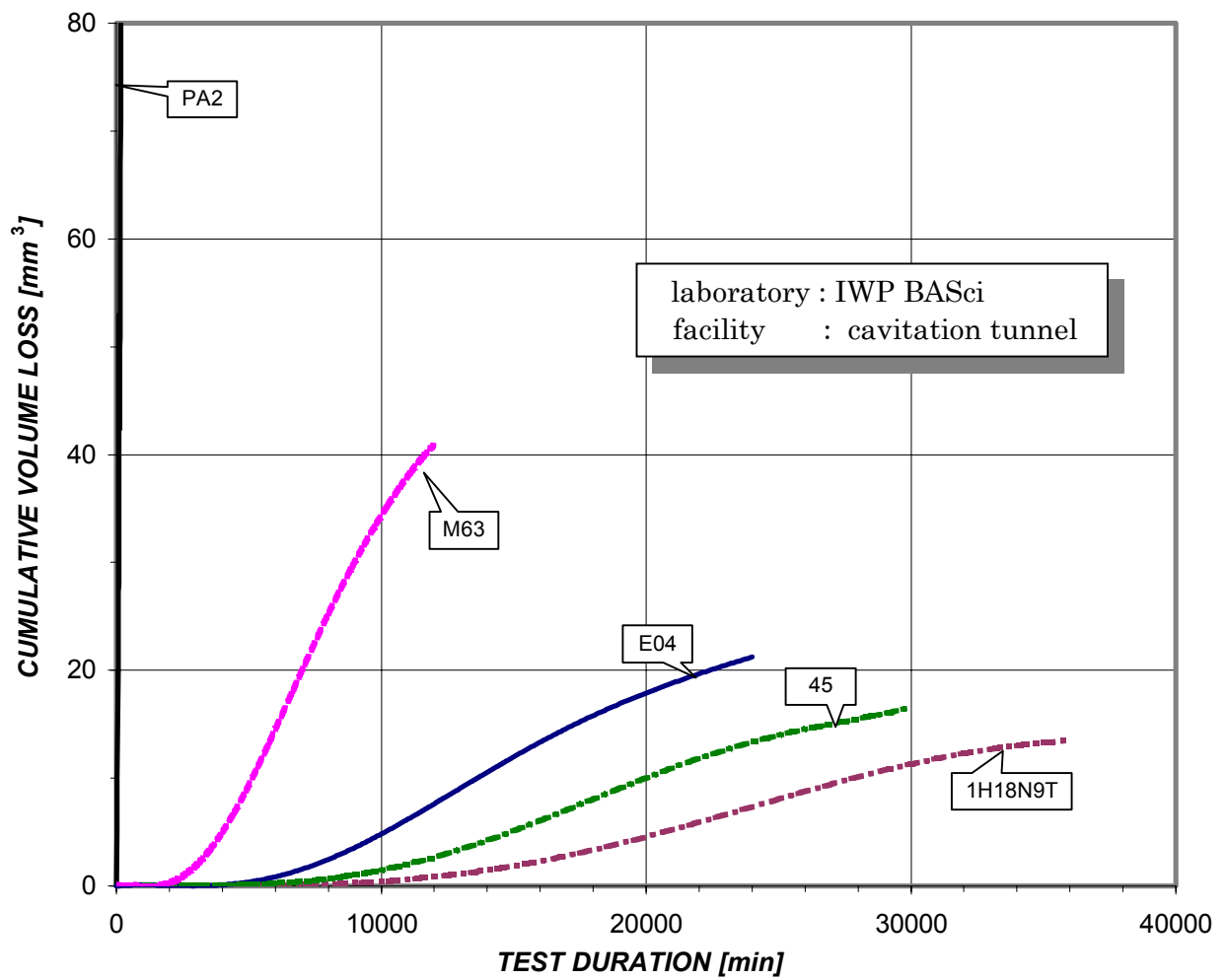
Facility: **CAVITATION TUNNEL**

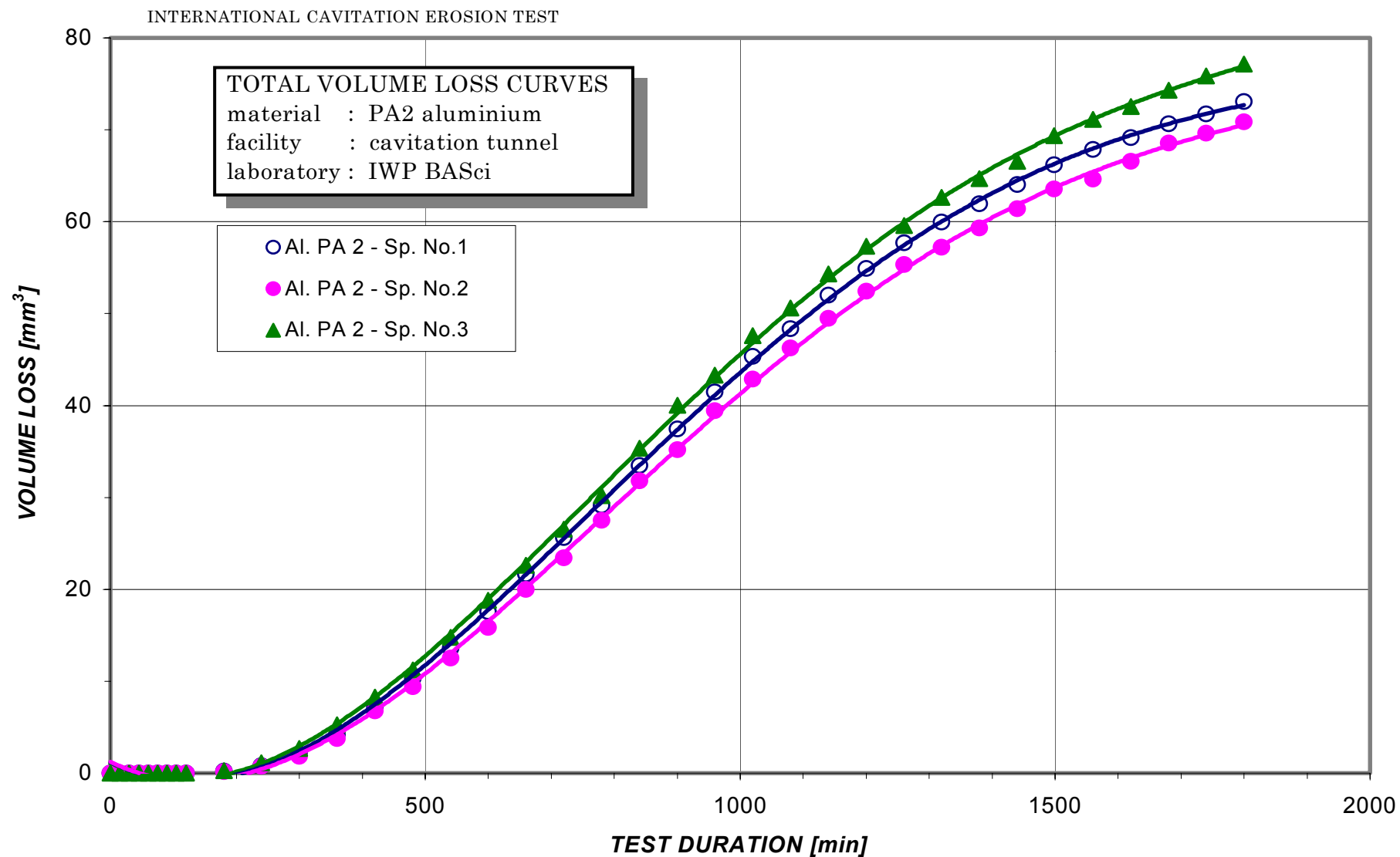
cavitator: cylindrical bolt pressure*: 1260,00 kPa
specimen: rectangular plate flow velocity: 22,50 m/s
 impinged area: 242.43 mm²

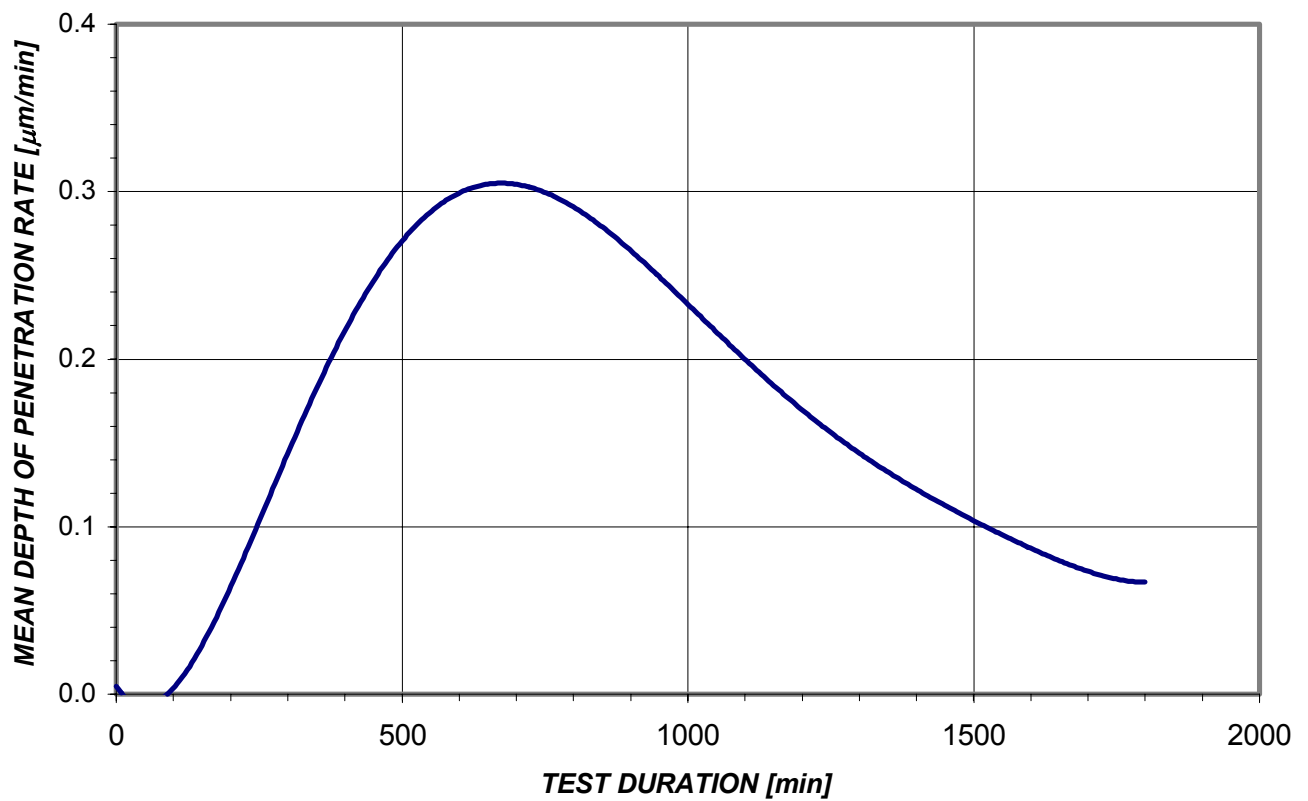
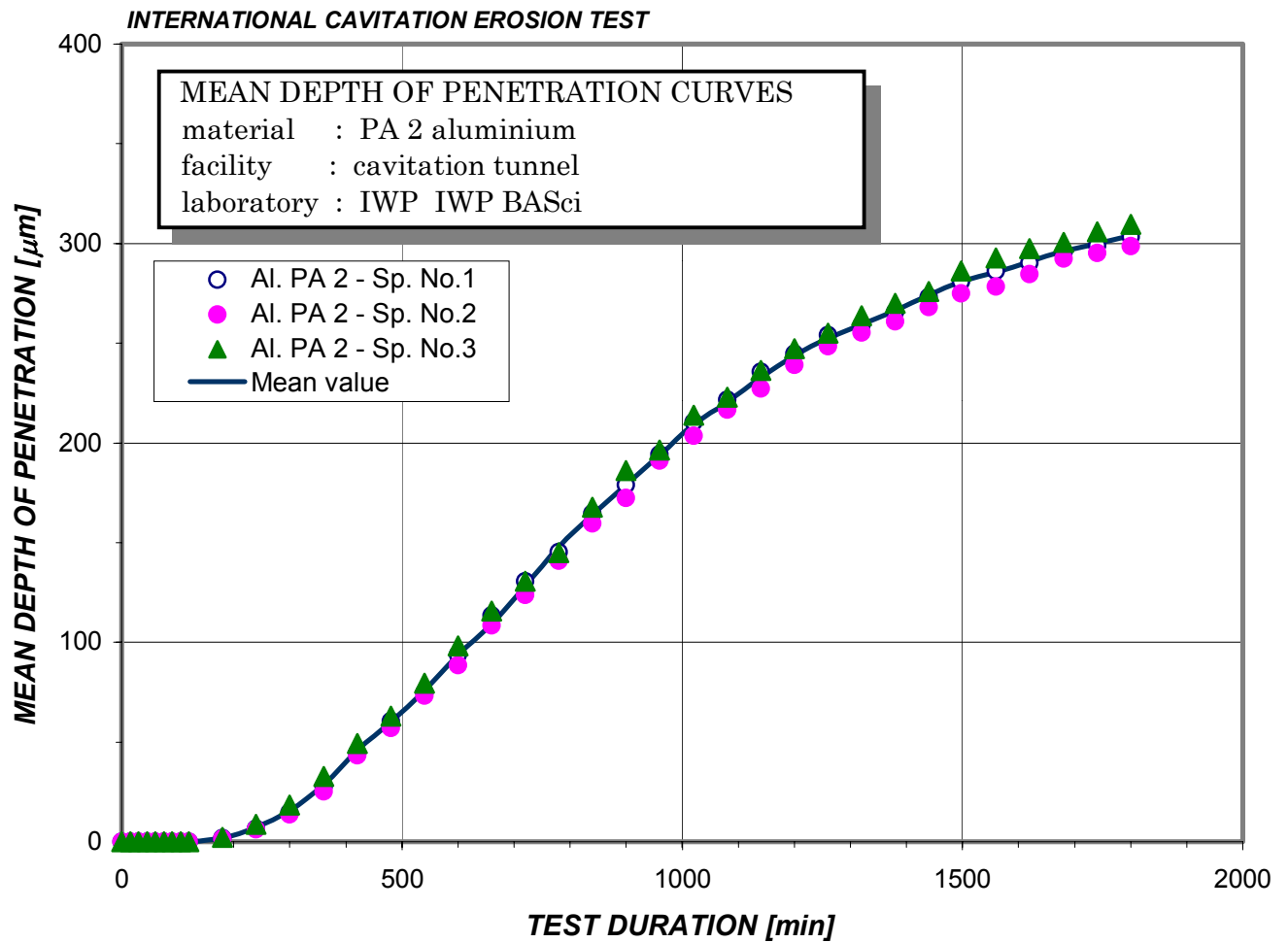
working liquid: tap water, pH = 7.5, dissolved oxygen content: 5.8 mg/dm³
 temperature: 15 - 17 °C
 chlorides - 32,77 mg/dm³, sulphates - 43,88 mg/dm³
 iron - 5,80 mg/dm³ turbidity - 14,00 mg/dm³

material	Test duration	Volume loss	Eroded area	Mean&Max Depth of Penetration		Incubation period		MDPR	
						$\tau_{0.2}$	τ_{inc}	max	ultimate
	min	mm ³	mm ²	µm	µm	min	min	µm/min	
PA2	1800	73.69	242.4	303.9	-	180	312	0.310	< 0.060
M63	1800	0.24	56.9	4.3	-	960	2850	0.008	0.008
M63	12000	40.97	100.9	406.0	-	960	2850	0.057	0.024
E04	12000	7.84	42.7	183.6	-	2500	6660	0.032	0.032
45	12000	2.66	31.8	83.73	-	3120	8460	0.019	0.019
1H18N9T	12000	0.76	29.3	25.97	-	5100	11800	0.008	0.008
E04	24000	21.18	52.9	400.3	-	2500	6660	0.033	0.011
45	24000	16.50	50.1	329.4	-	3120	8460	0.022	0.013
1H18N9T	24000	7.19	38.1	188.7	-	5100	11800	0.016	0.015
45	30000	16.50	50.1	329.4	-	3120	8460	0.022	0.003
1H18N9T	30000	11.30	42.5	265.9	-	5100	11800	0.016	0.008
1H18N9T	36000	13.56	47.2	287.3	-	5100	11800	0.016	<0.001

* gauge pressure

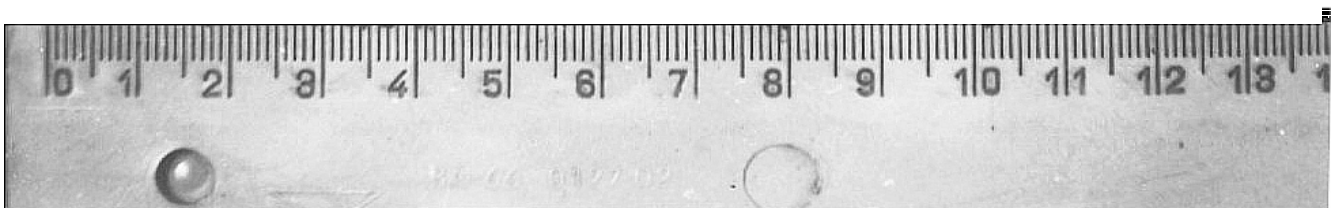
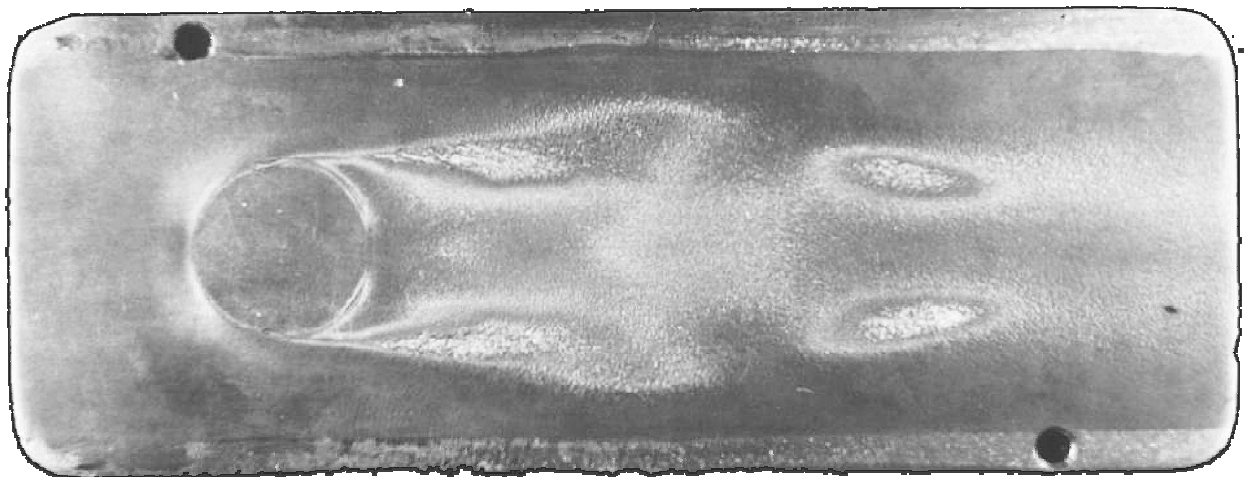
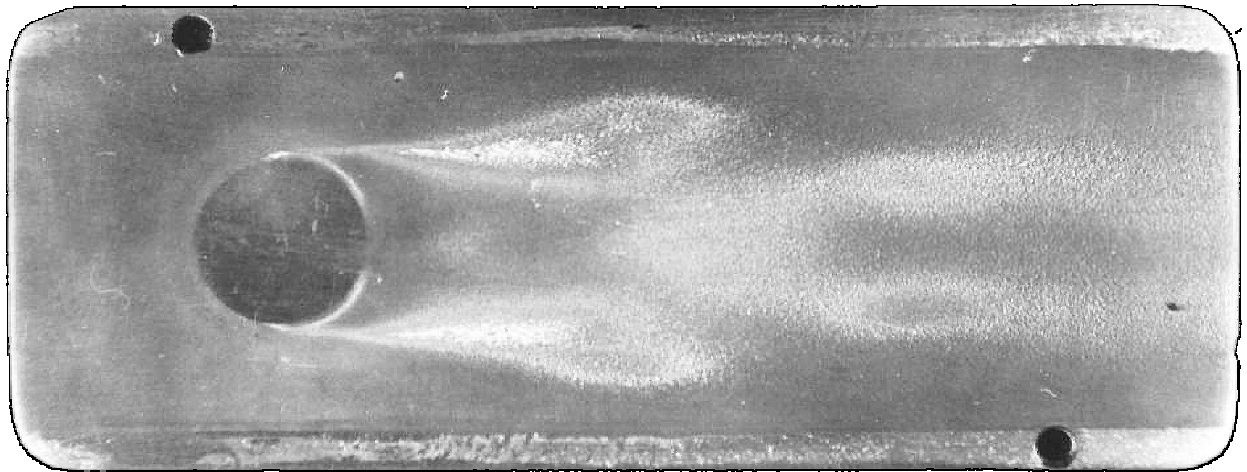






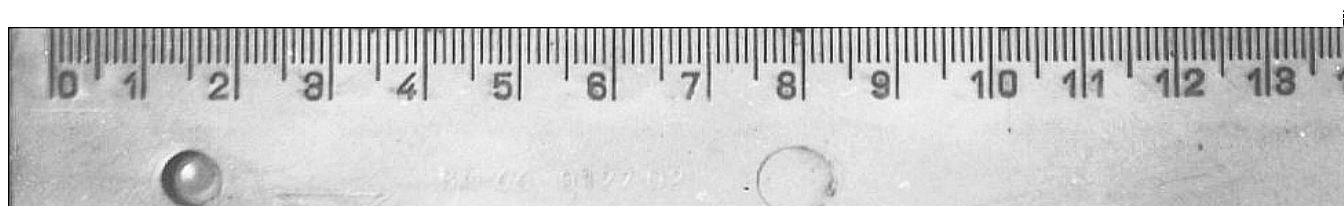
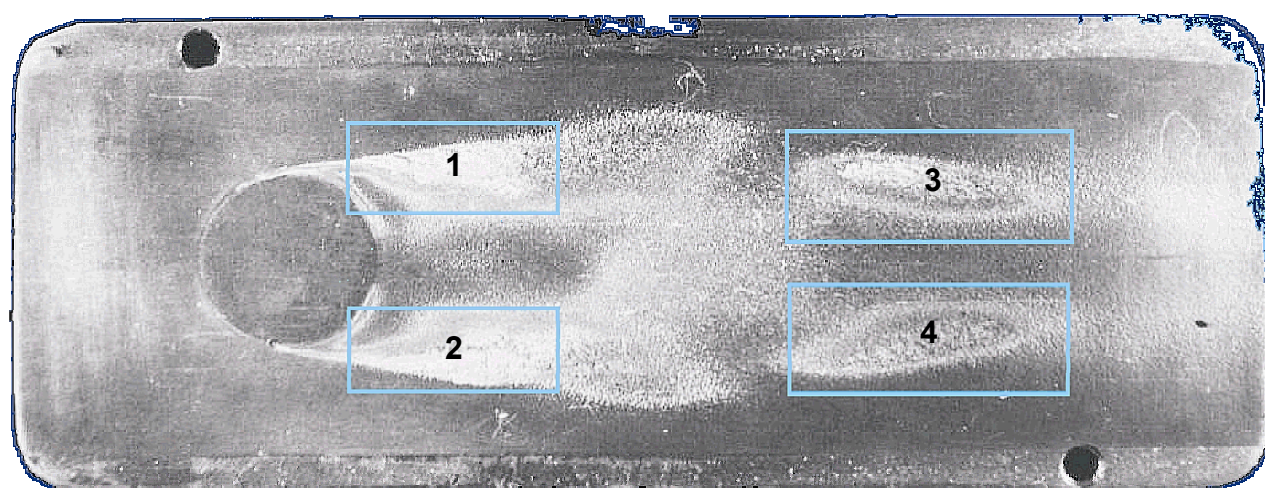
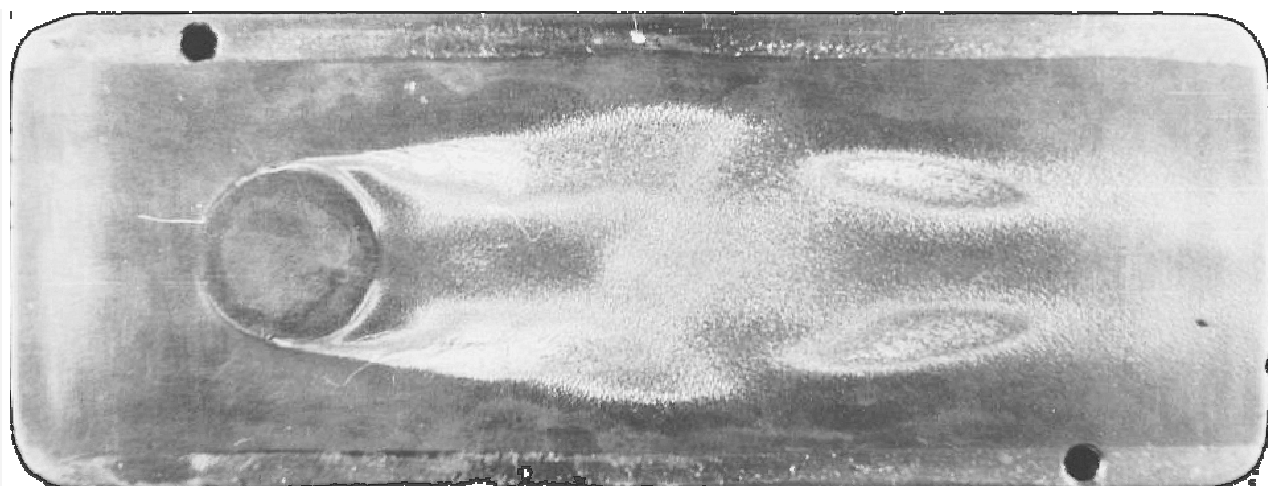
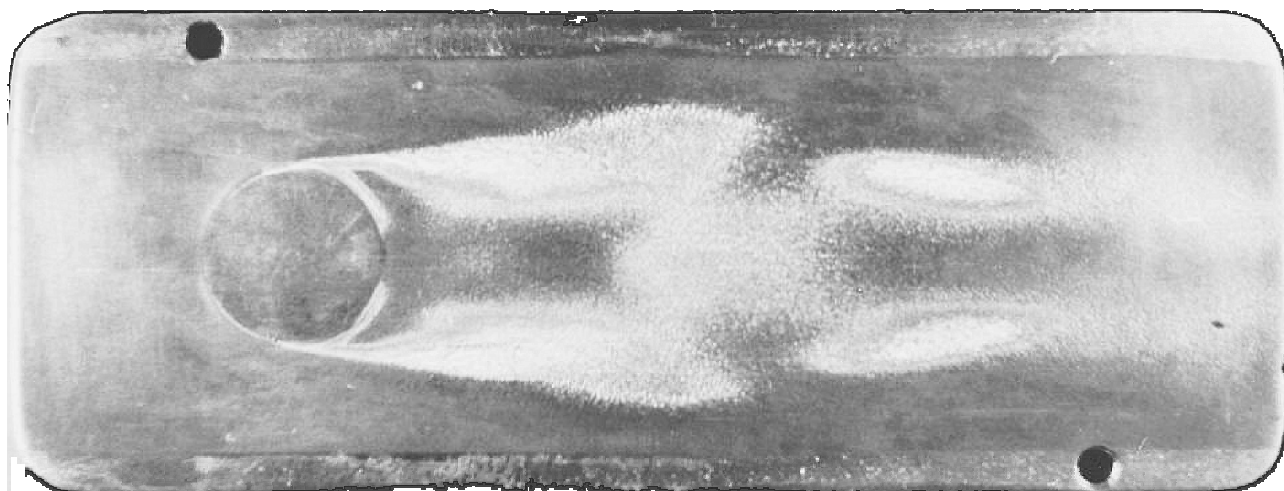
Enclosure 1: Photographs of eroded surface

specimen no.3 prior to the test, and after 360 and 720 minutes of exposure, respectively



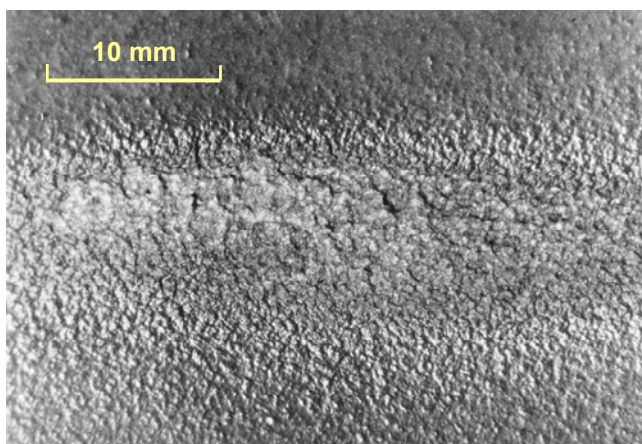
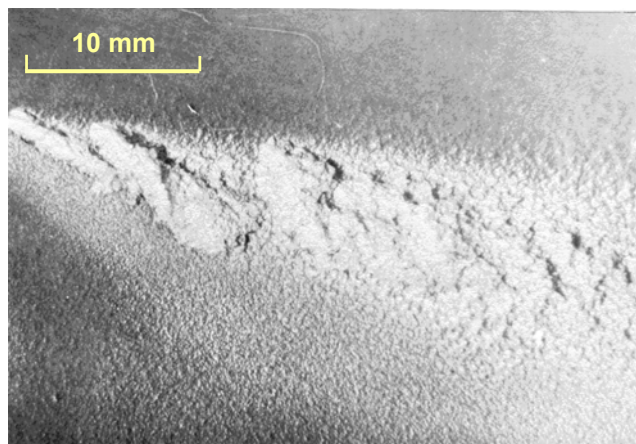
Enclosure 1: Photographs of eroded surface (*continued*)

specimen no.3 after 1080, 1320 and 1800 minutes of exposure, respectively

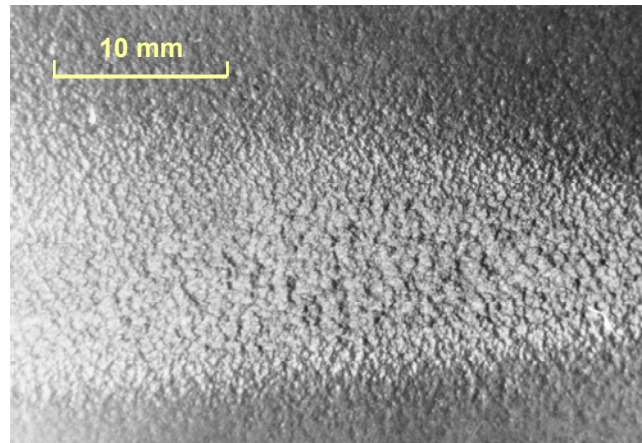
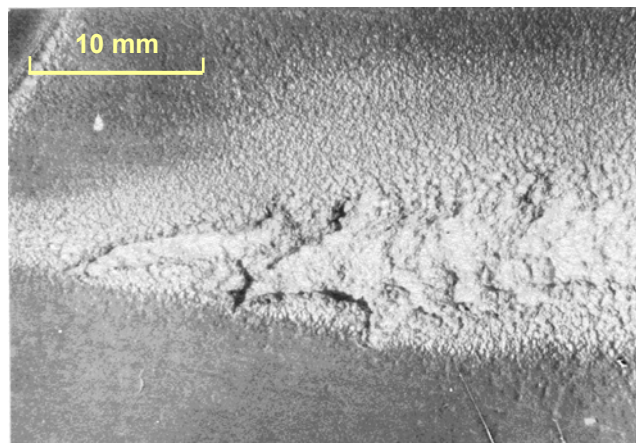


Enclosure 1: Photographs of eroded surface (*continued*)

TOPOGRAPHY OF THE ERODED SURFACE

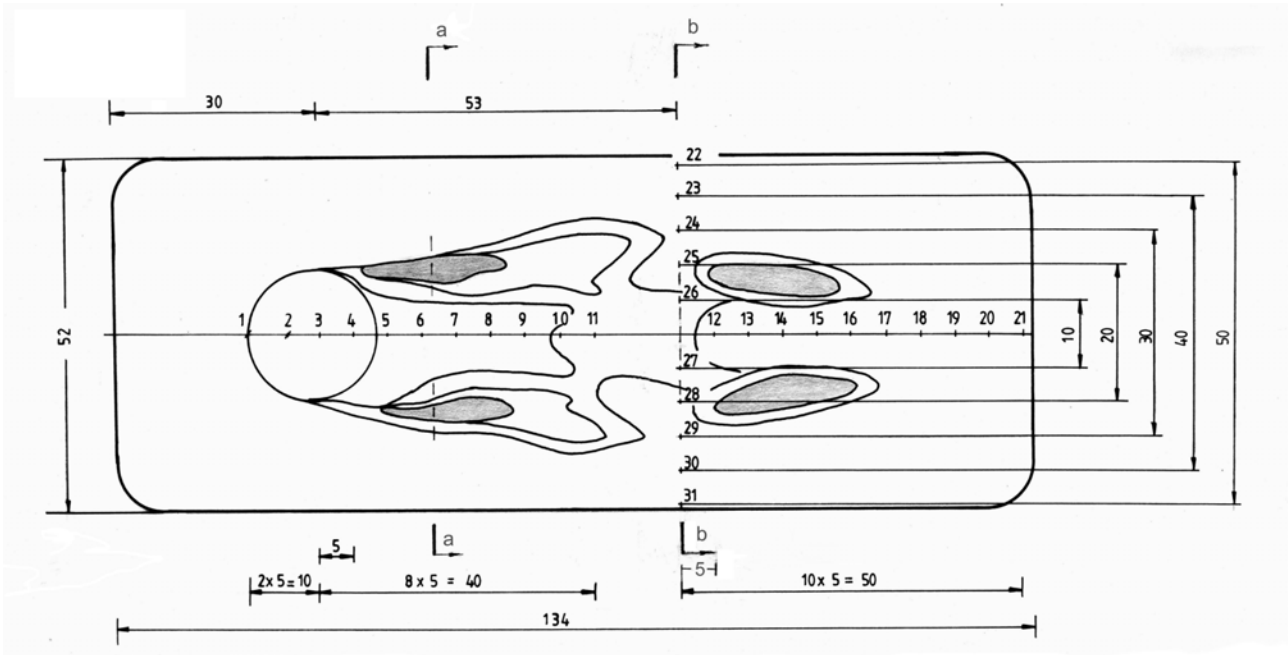


Erosion zones no.1 and 3

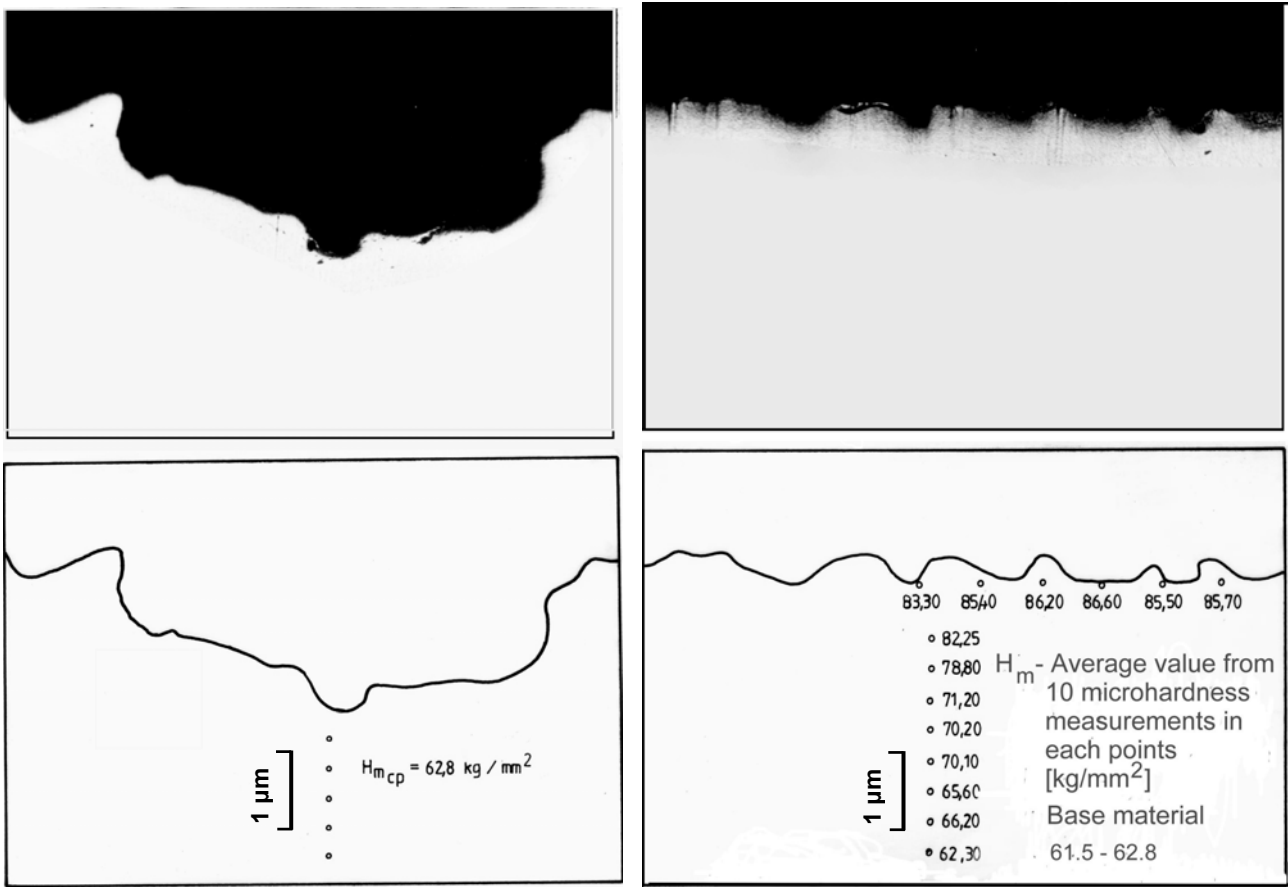


Erosion zones no.2 and 4

Enclosure 2&3: Microsection photographs Results of hardness and microhardness measurement



Test specimen with indicated erosion zones, sites of hardness measurement and planes of microhardness tests



Microsection taken from specimen section (a-a) in the zone of intense erosion with the average value and sites of HV_{25g} microhardness measurement indicated

Microsection taken from specimen section (b-b) in the zone of intense erosion showing local values of HV_{25g} microhardness at the surface and the average values at lower layers

Enclosure 3: Results of hardness and microhardness measurement *(continued)*

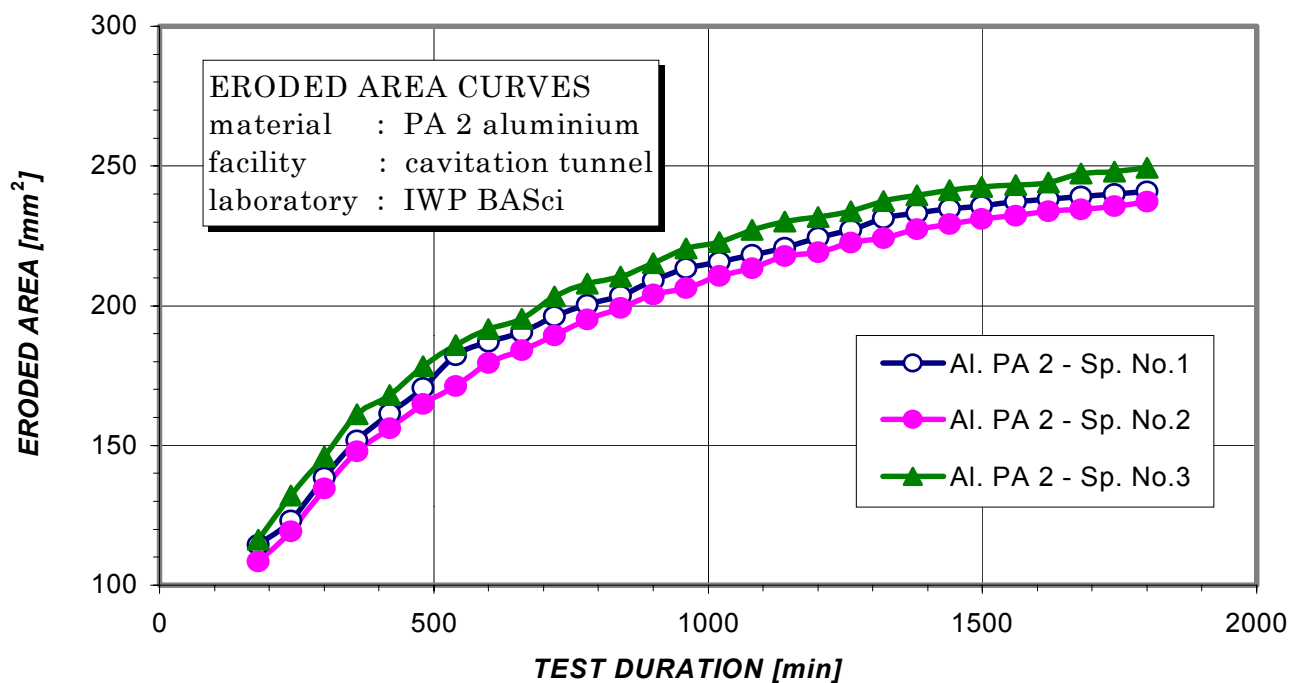
HARDNESS (according to Vickers)

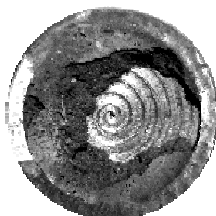
Loading force: 5 kG (HV₅)

Units applied: kG/m²

Measurement point	1	2	3	4	5	6	7	8	9	10	11
Specimen no.1	54,8	55,2	55,7	56,8	56,8	58,3	61,6	64,6	65,8	64,3	63,9
Specimen no.2	56,4	57,0	56,8	57,0	58,1	59,2	62,3	65,6	63,2	65,2	64,2
Specimen no.3	57,2	56,1	56,1	56,3	56,3	58,7	59,8	62,7	67,0	62,3	65,1
Measurement point	12	13	14	15	16	17	18	19	20	21	
Specimen no.1	66,7	67,2	65,7	64,0	65,1	62,0	62,3	62,0	62,3	62,3	
Specimen no.2	63,3	62,9	61,6	61,6	62,7	61,3	61,7	61,4	61,2	60,9	
Specimen no.3	65,7	65,5	63,6	61,9	64,9	60,8	60,1	60,2	60,0	60,1	
Measurement point	22	23	24	25	26	27	28	29	30	31	
Specimen no.1	58,7	59,3	66,2	67,1	66,5	66,9	67,2	66,6	59,1	58,9	
Specimen no.2	58,3	58,1	67,0	66,3	65,1	65,5	66,1	67,7	58,3	58,0	
Specimen no.3	58,0	58,6	66,2	64,2	63,6	63,8	64,1	66,0	58,8	58,1	

Enclosure 4: Eroded area curves





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Laboratory: INSTITUTE OF WATER PROBLEMS
OF THE BULGARIAN ACADEMY OF SCIENCES
SOFIA, Bulgaria

Facility: CAVITATION TUNNEL

cavitator: cylindrical bolt *pressure:* 1260,00 kPa
specimen: rectangular plate *flow velocity:* 22,50 m/s
 impinged area: 242.43 mm²

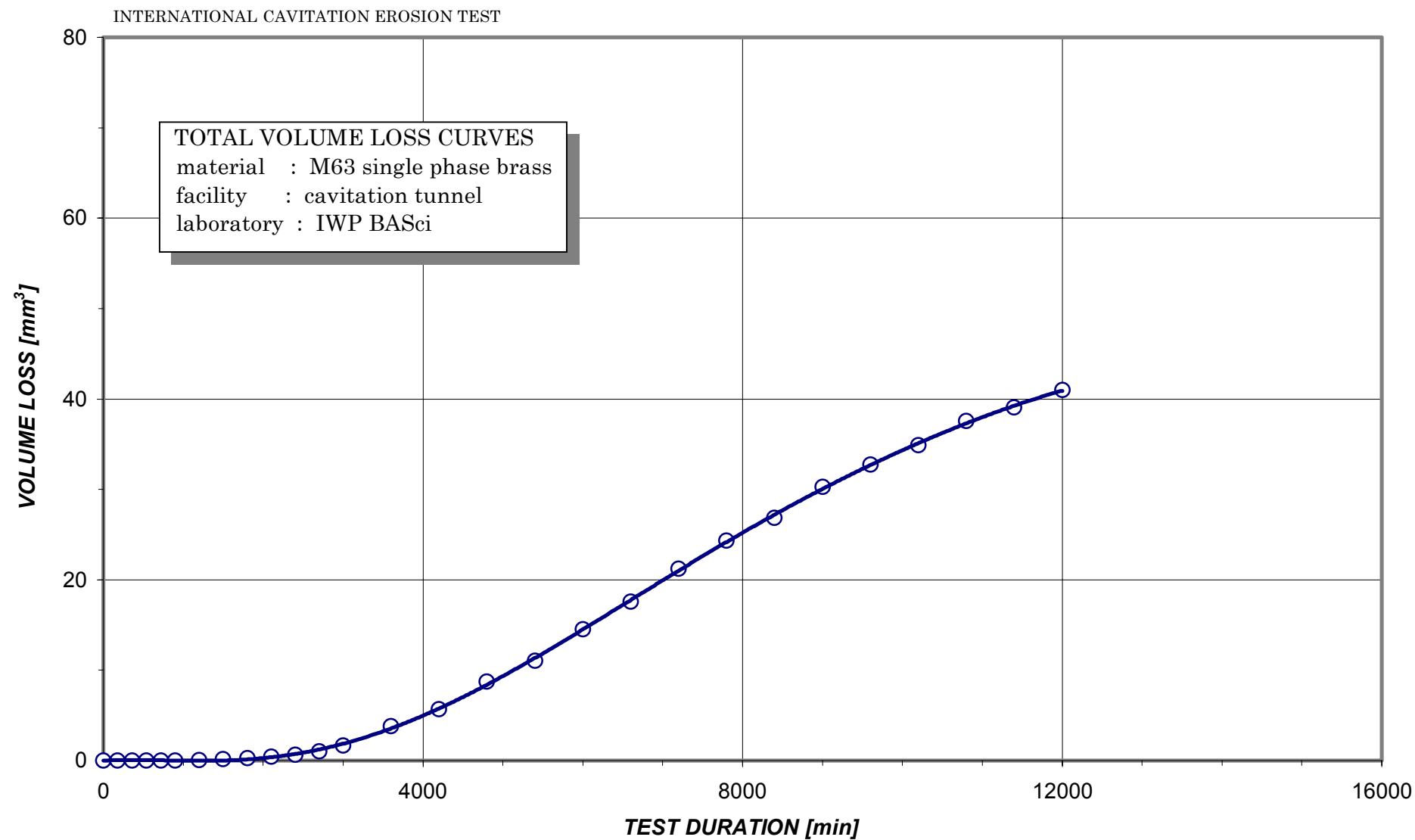
working liquid: tap water, pH = 7.5, dissolved oxygen content: 5.8 mg/dm³
 temperature: 15 ÷ 17 °C
 chlorides - 32,77 mg/dm³, sulphates - 43,88 mg/dm³
 iron - 5,80 mg/dm³ turbidity - 14,00 mg/dm³

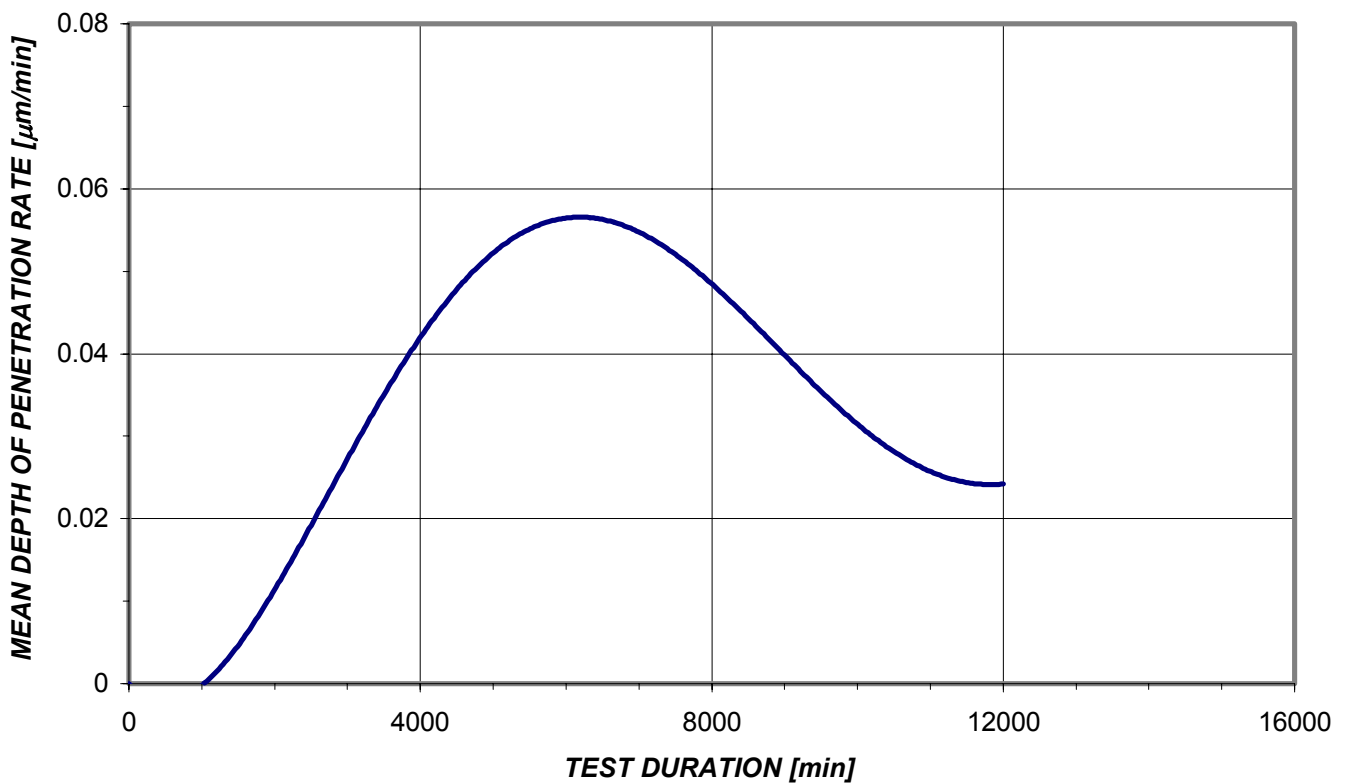
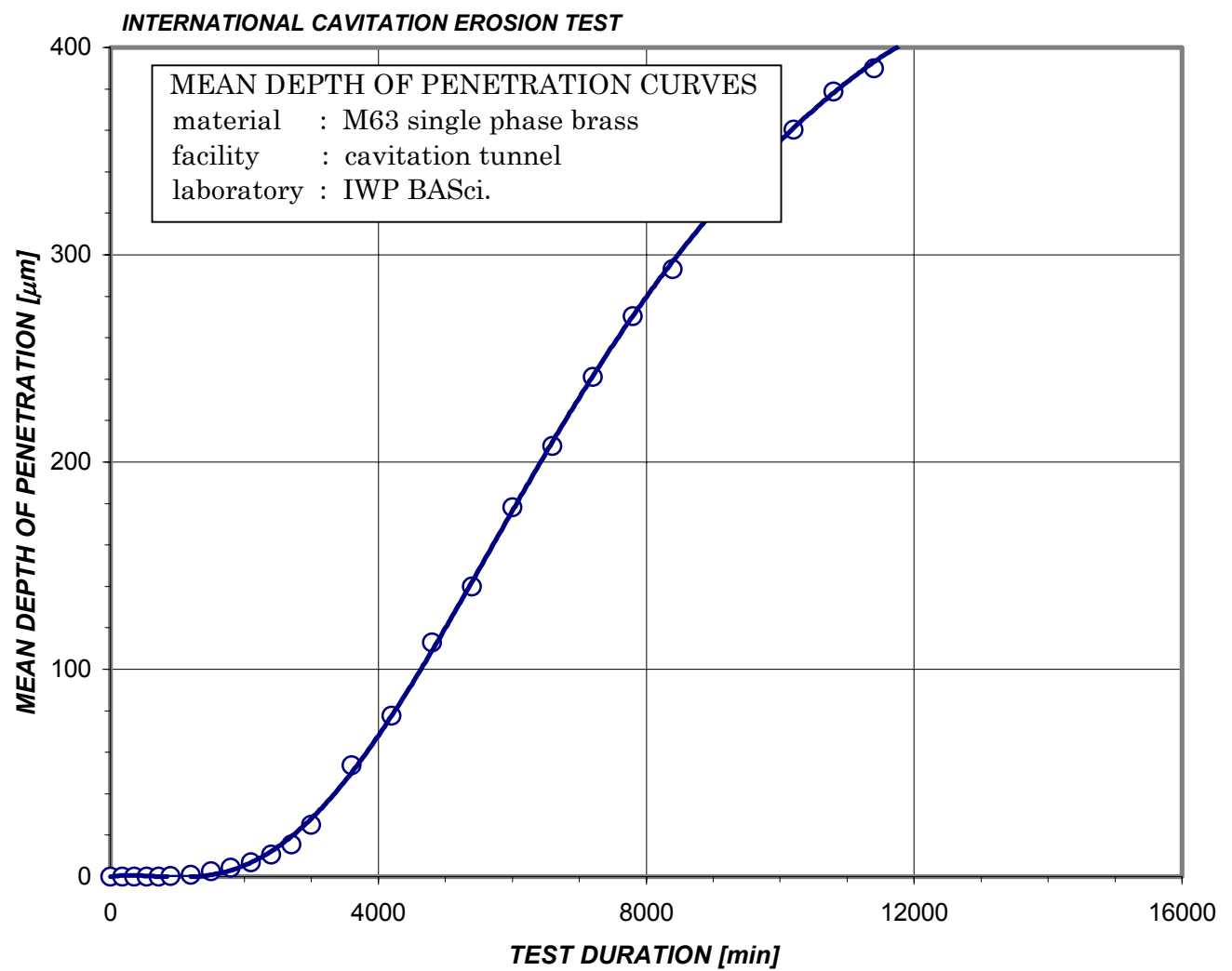
Material: M63 brass

<i>speci- men</i>	<i>test duration</i>	<i>mass loss</i>	<i>volume loss</i>	<i>eroded area</i>	<i>Mean&Max Depth of Penetration</i>		<i>Incubation period</i>		<i>MDPR_{max}</i>
					μm	μm	τ _{0.2} min	τ _{inc} min	
no.	min	g	mm ³	mm ²					μm/min
4.	12000	0.34535	40.97	100.9	406.01	-	960	2850	0.0567

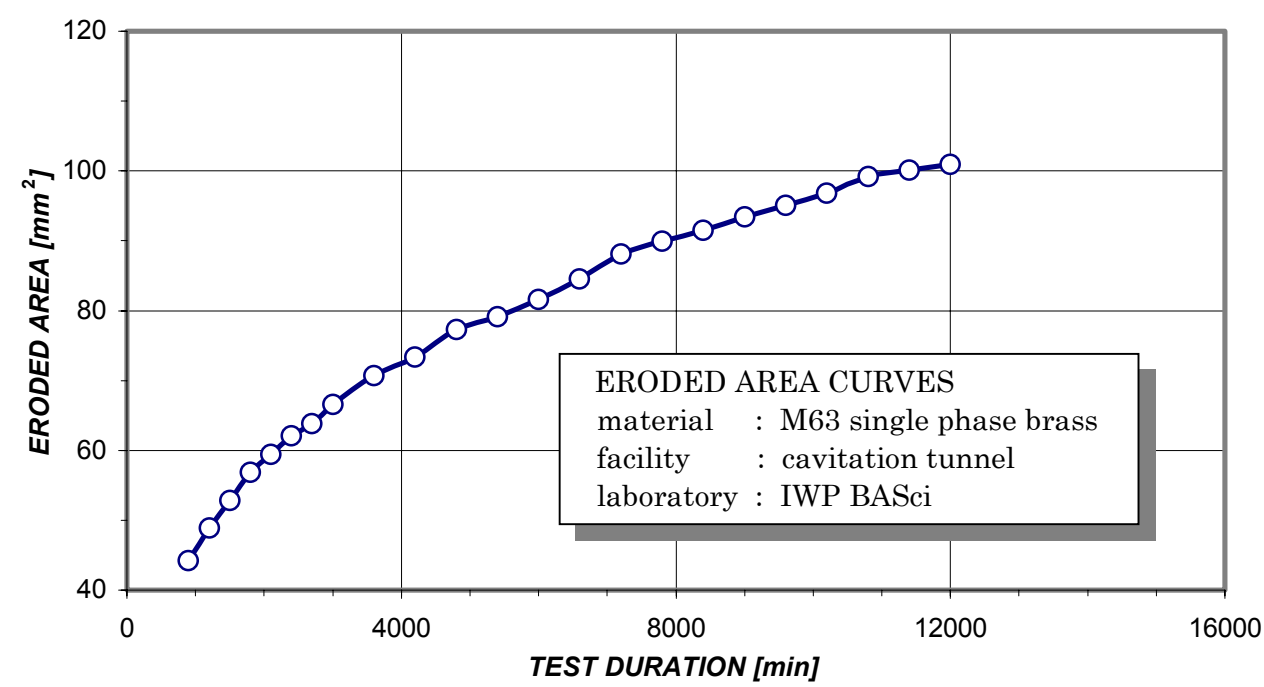
Enclosure

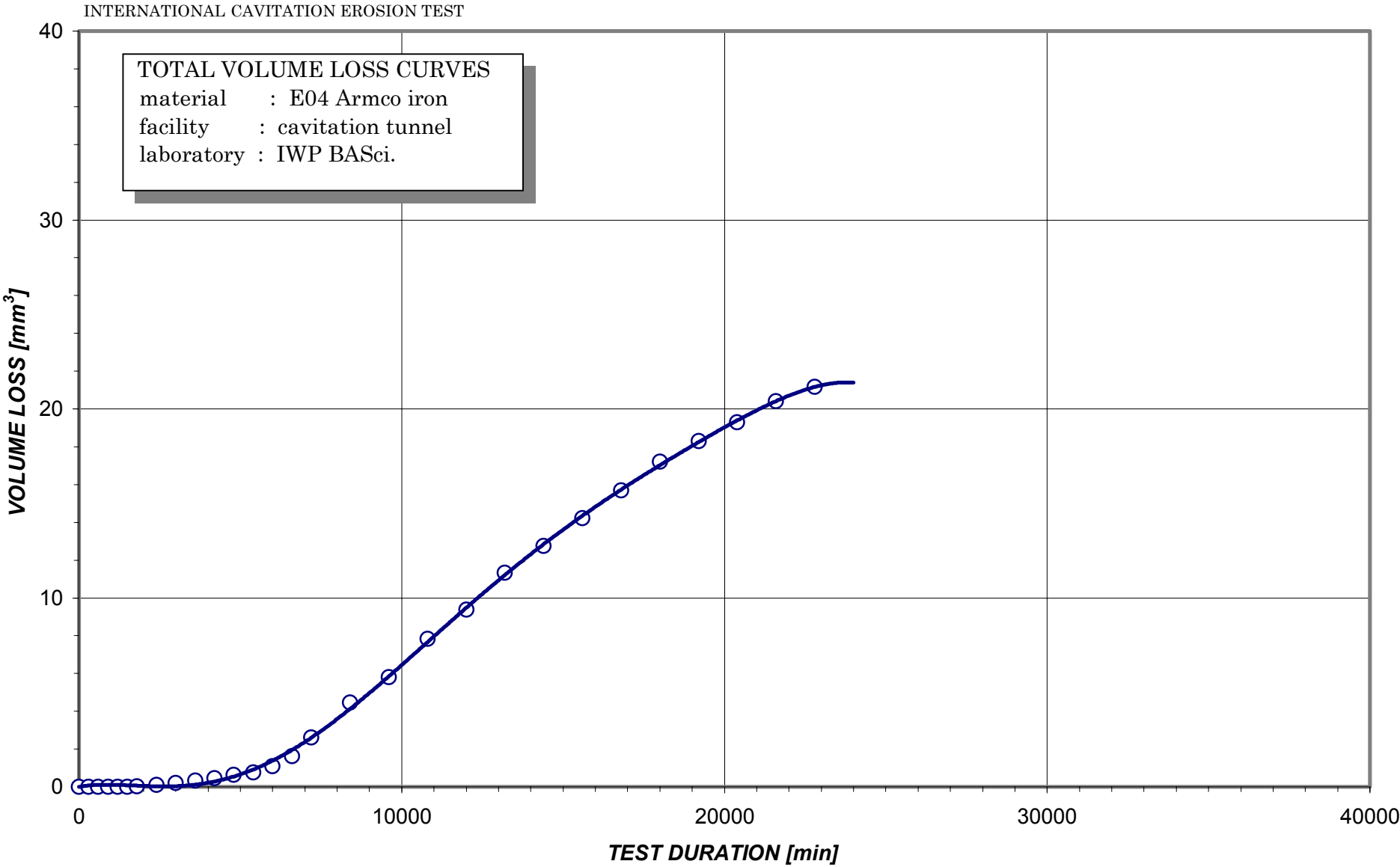
Eroded area curve

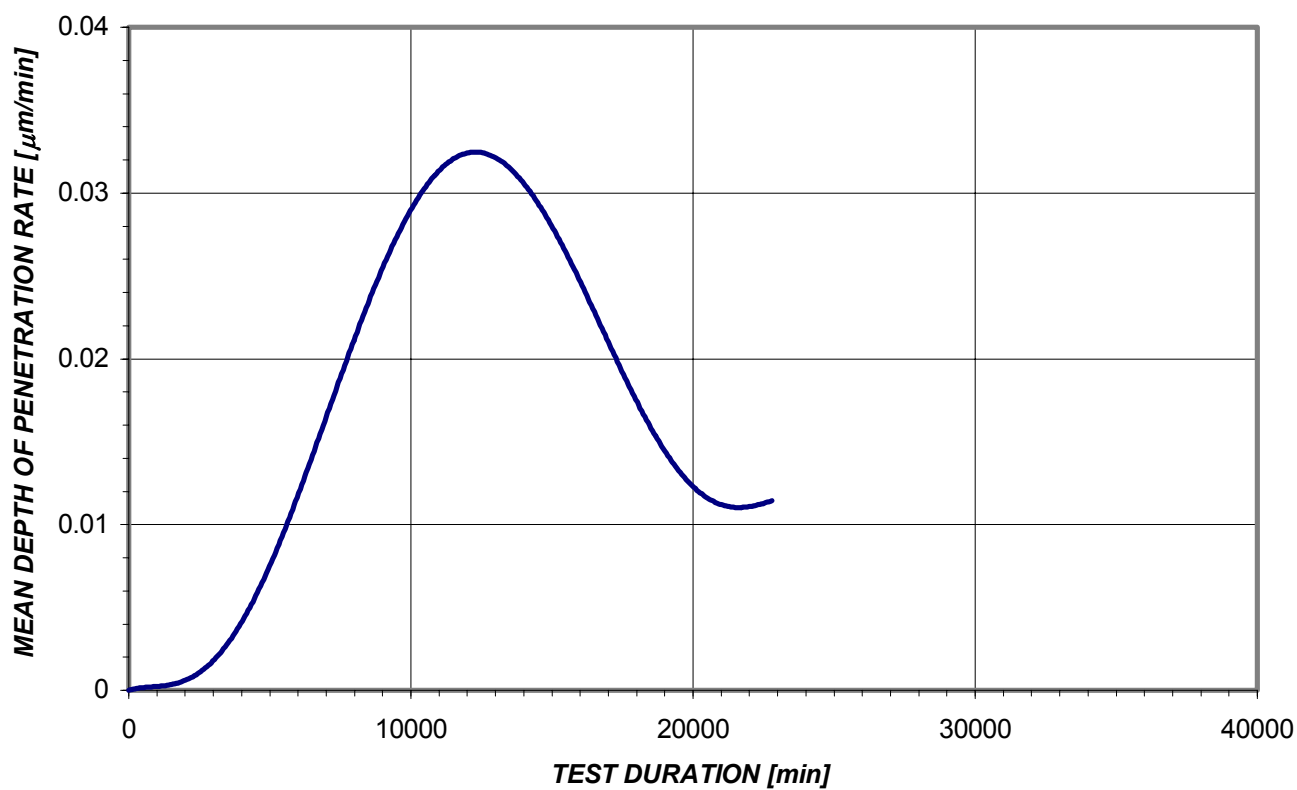
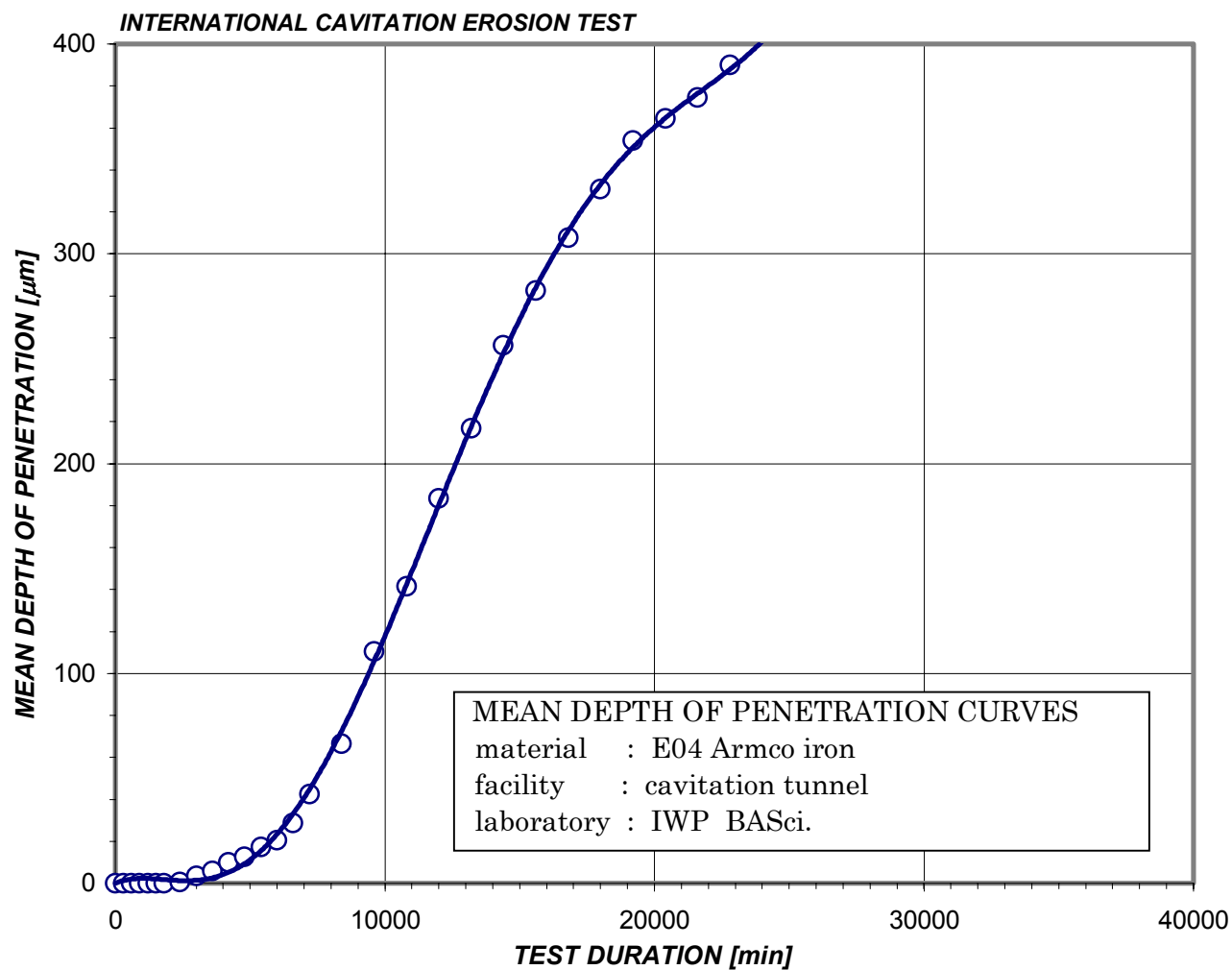




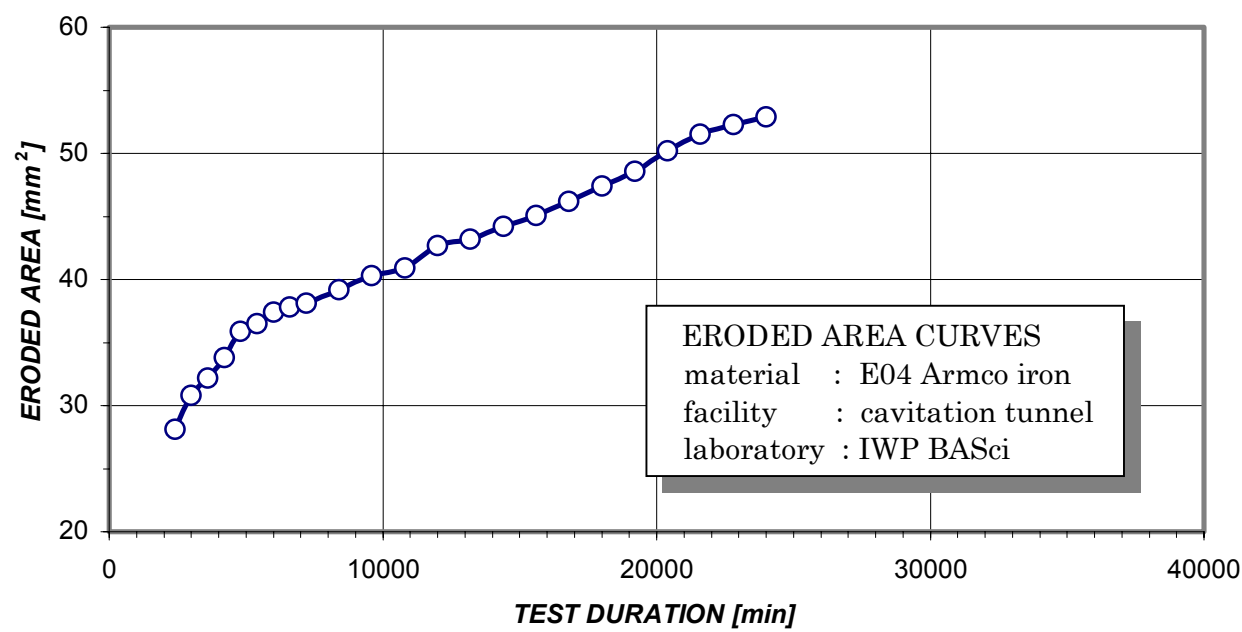
Enclosure: Eroded area curve

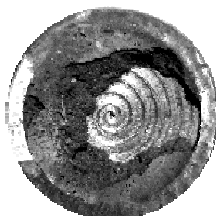






Enclosure: Eroded area curve





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SOFIA, Bulgaria

Facility: CAVITATION TUNNEL

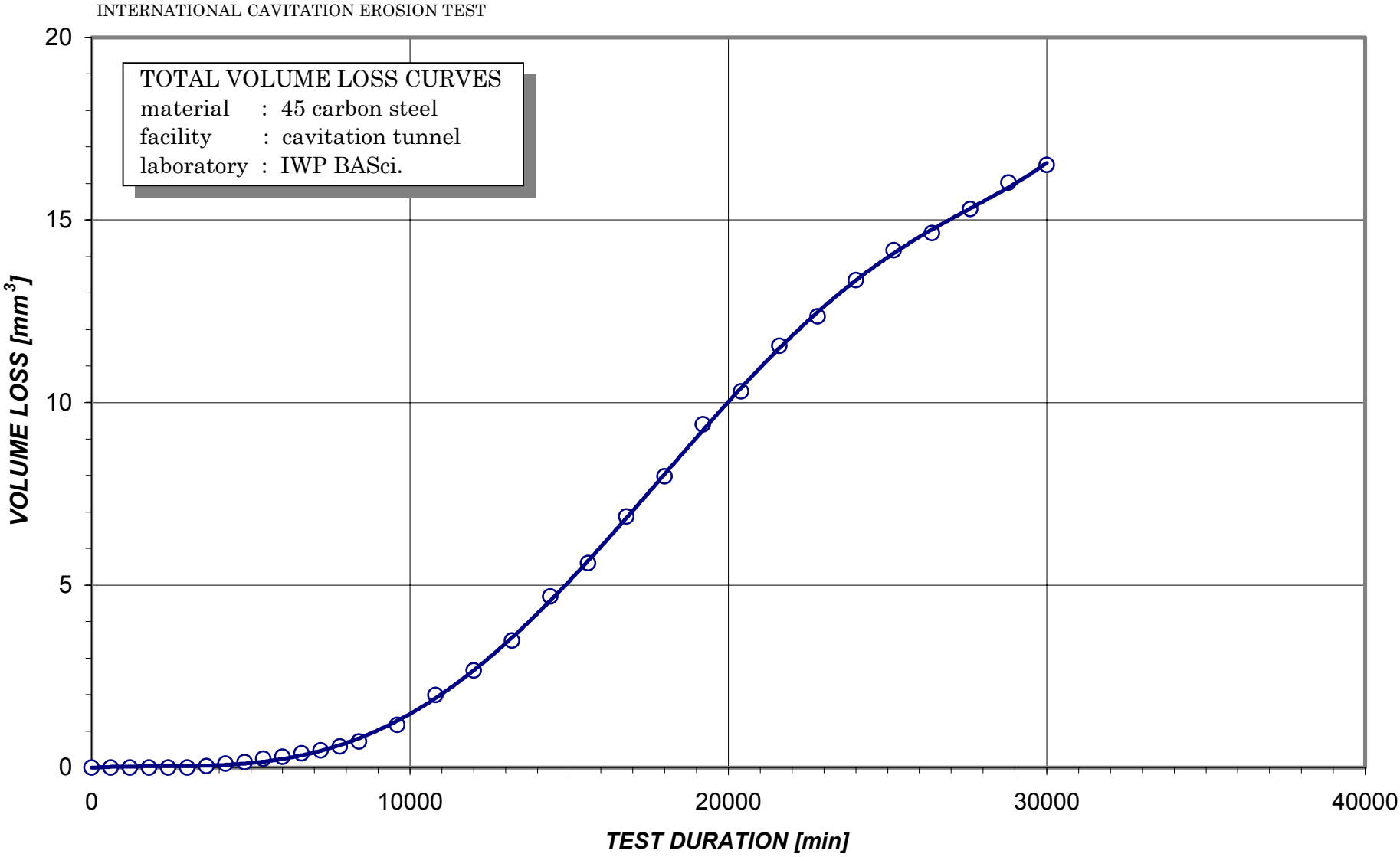
<i>cavitator:</i>	cylindrical bolt	<i>pressure:</i>	1260,00 kPa
<i>specimen:</i>	rectangular plate	<i>flow velocity:</i>	22,50 m/s
		<i>impinged area:</i>	242.43 mm ²
<i>working liquid:</i>	tap water, pH = 7.5, dissolved oxygen content: 5.8 mg/dm ³		
	temperature: 15 ÷ 17 °C		
	chlorides - 32,77 mg/dm ³ ,	sulphates - 43,88 mg/dm ³	
	iron - 5,80 mg/dm ³	turbidity - 14,00 mg/dm ³	

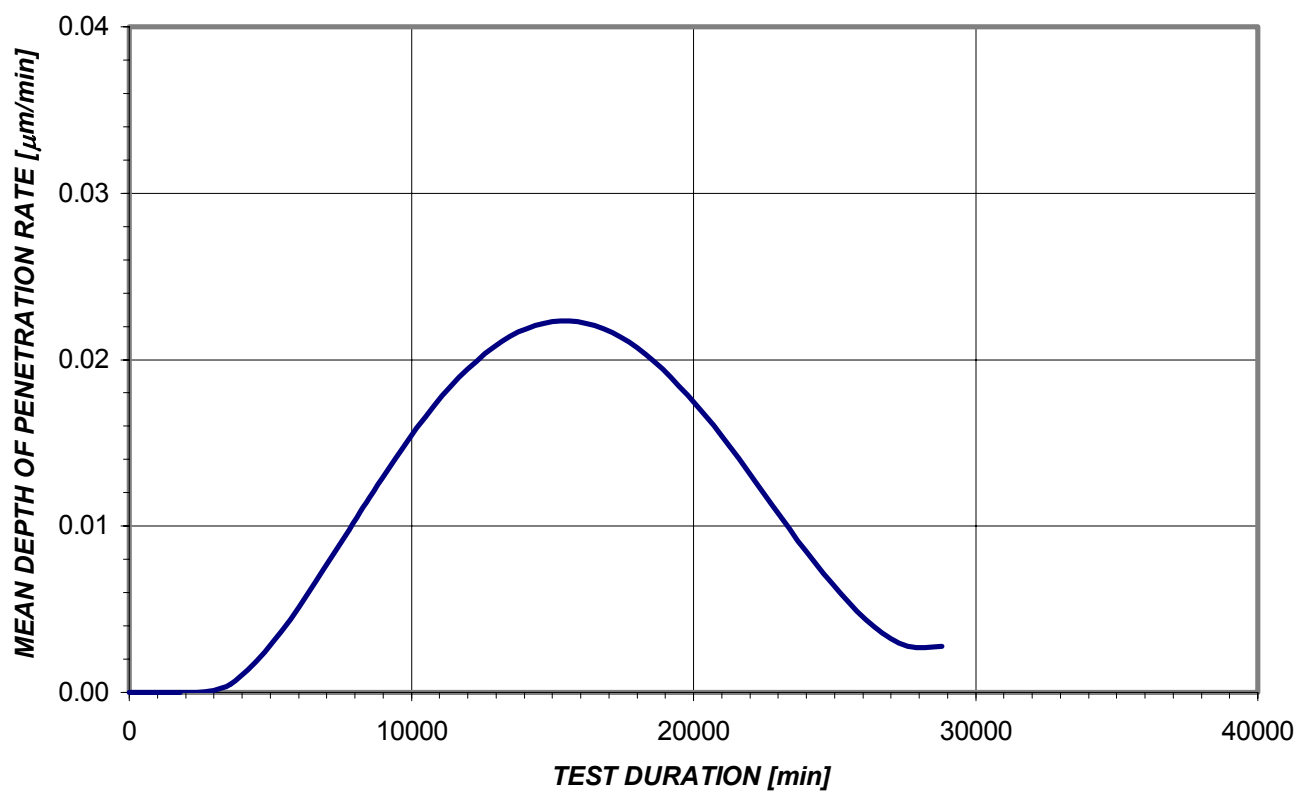
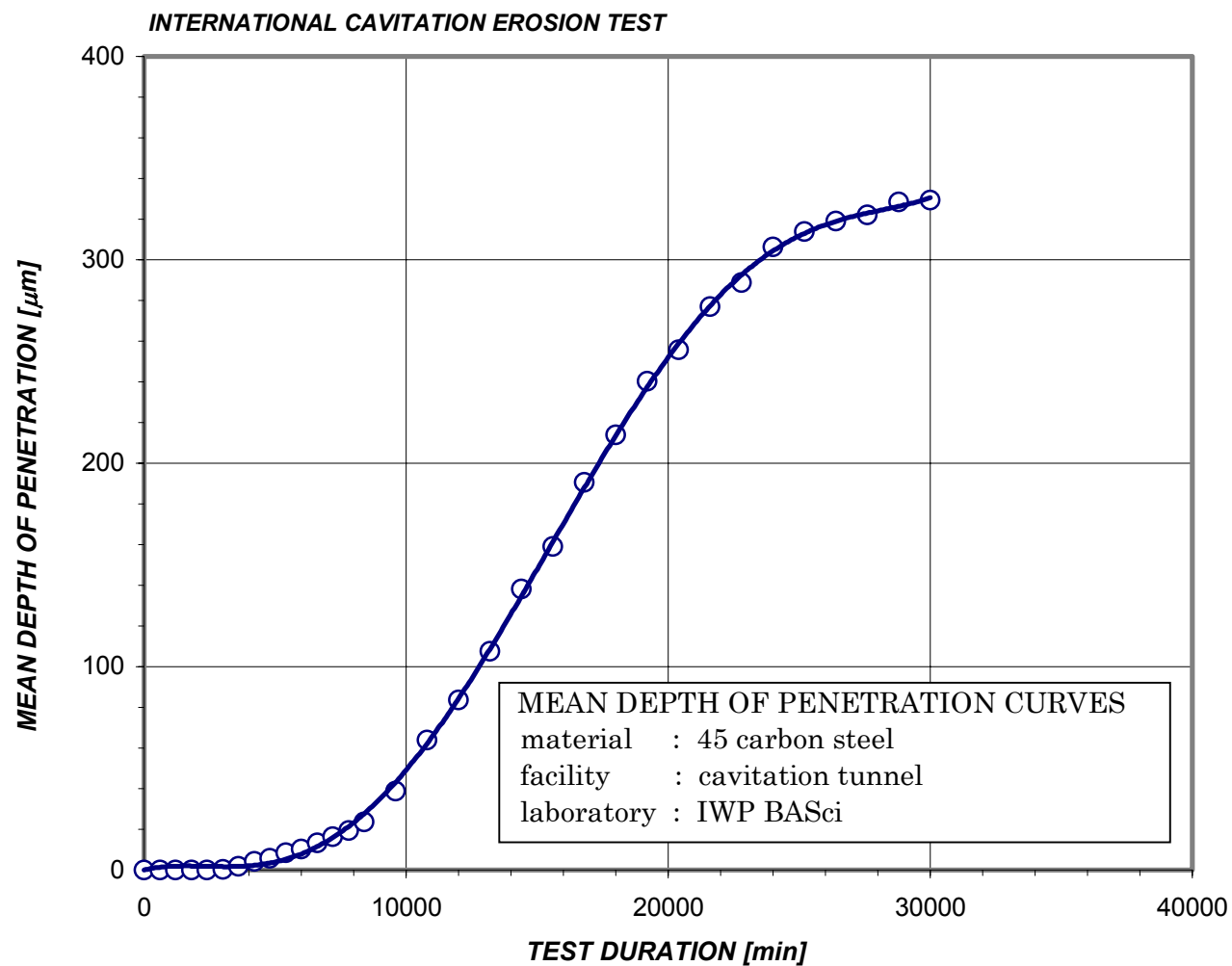
Material: 45 carbon steel

<i>speci- men</i>	<i>test duration</i>	<i>mass loss</i>	<i>volume loss</i>	<i>eroded area</i>	<i>Mean&Max Depth of Penetration</i>		<i>Incubation period</i>		<i>MDPR_{max}</i>
							$\tau_{0.2}$	τ_{inc}	
no.	min	g	mm ³	mm ²	µm	µm	min	min	µm/min
6.	30 000	0.12985	16.50	50.1	329.41	-	3120	8460	0.0222

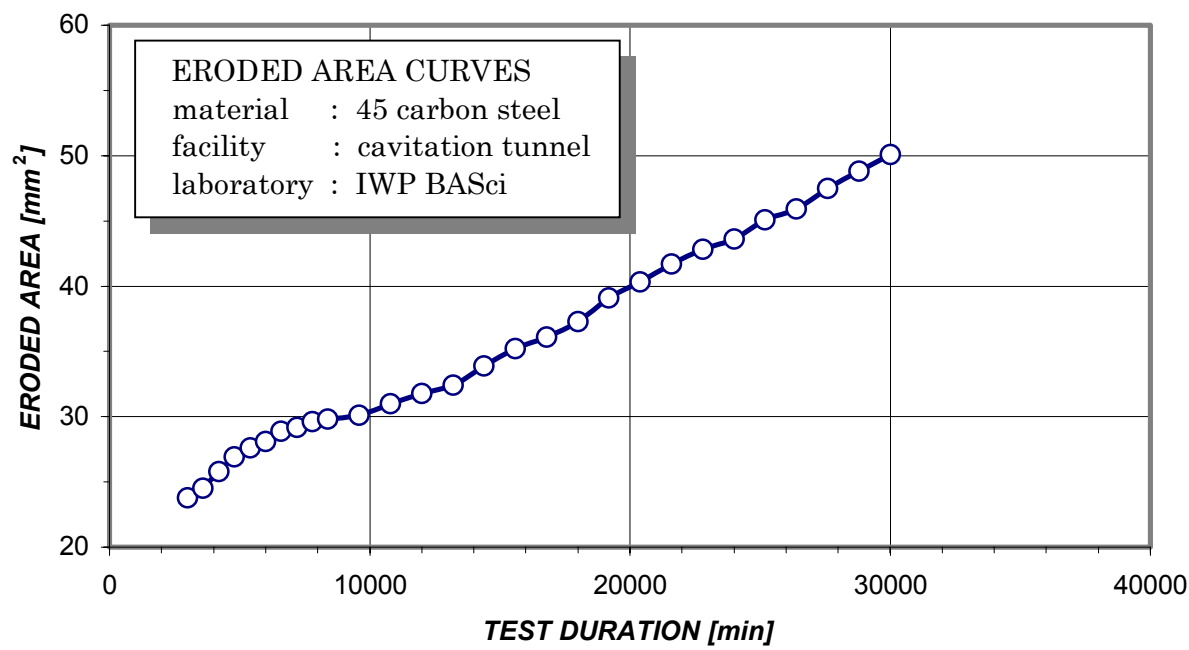
Enclosures

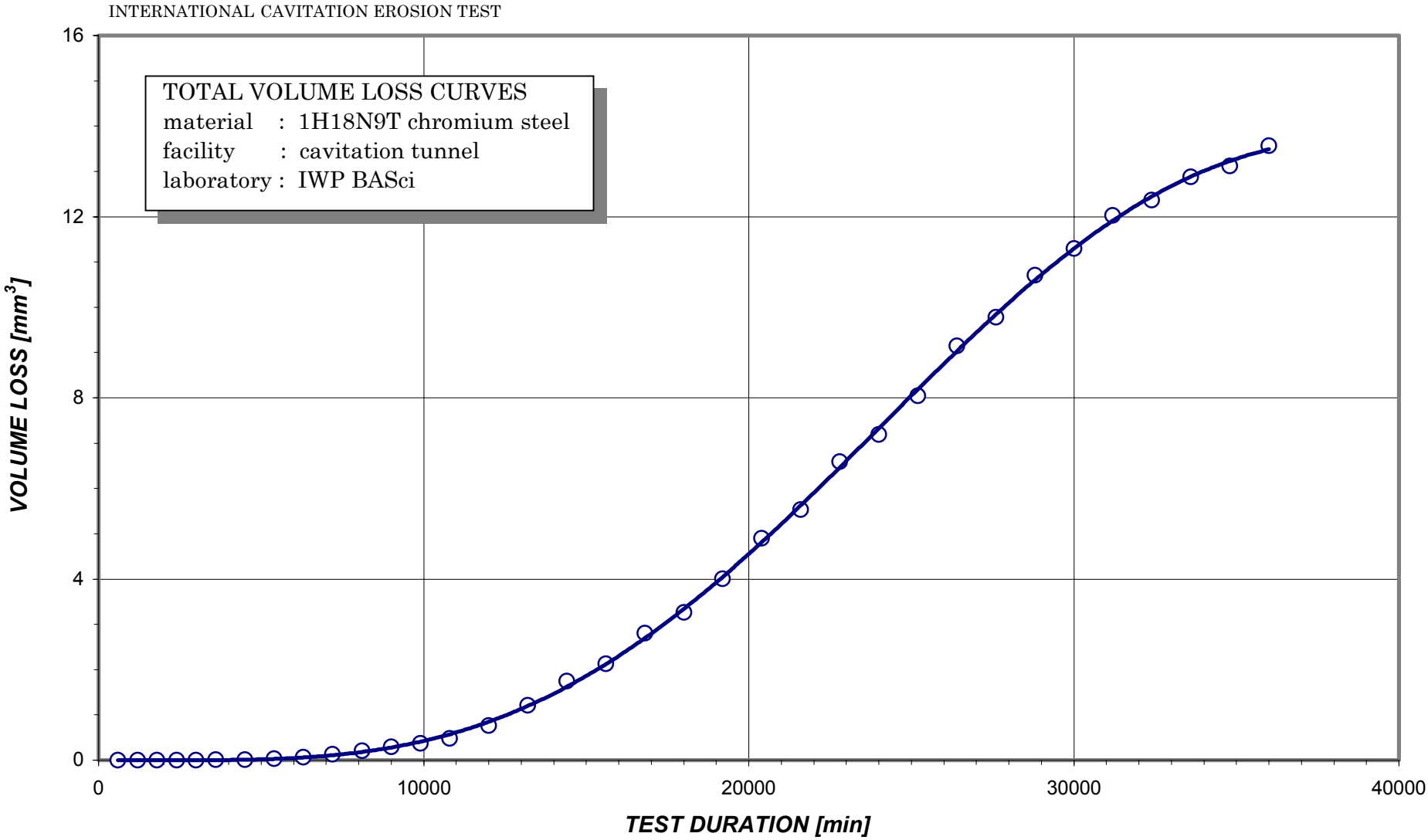
Eroded area curve



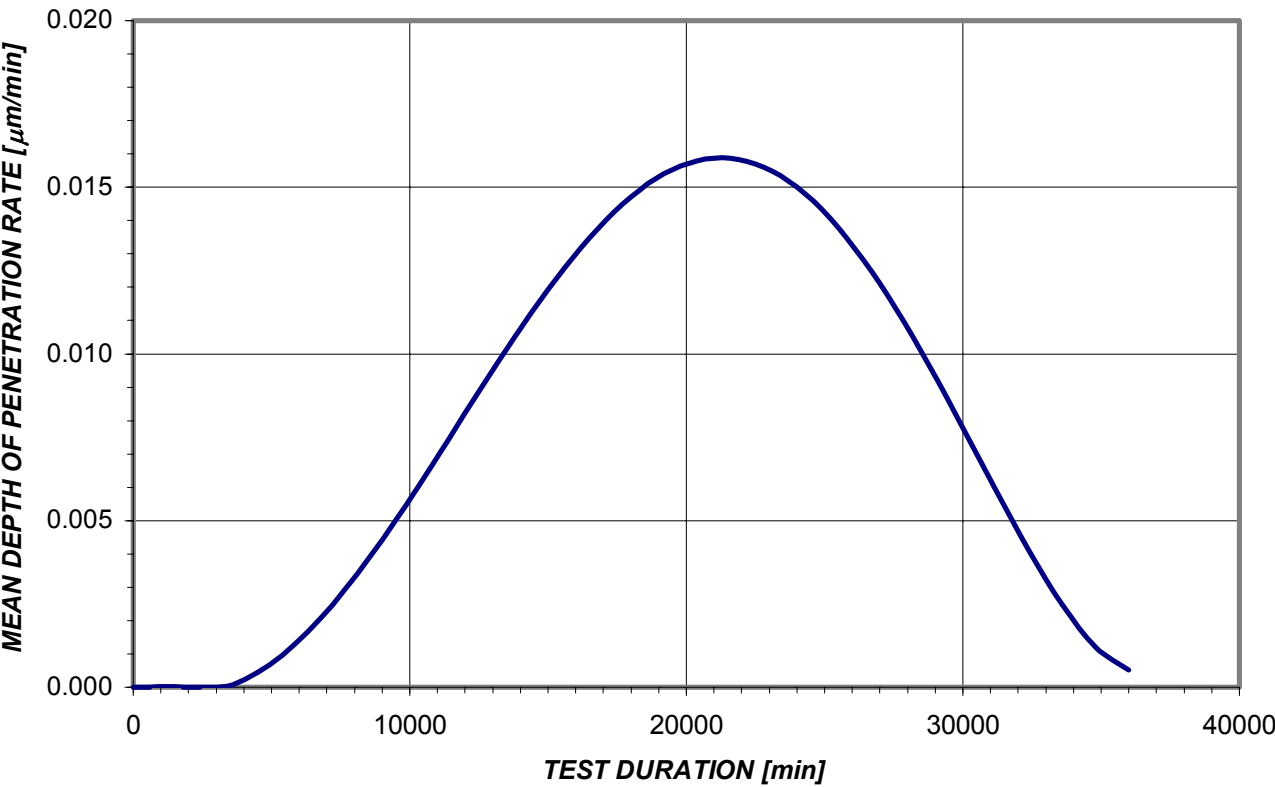
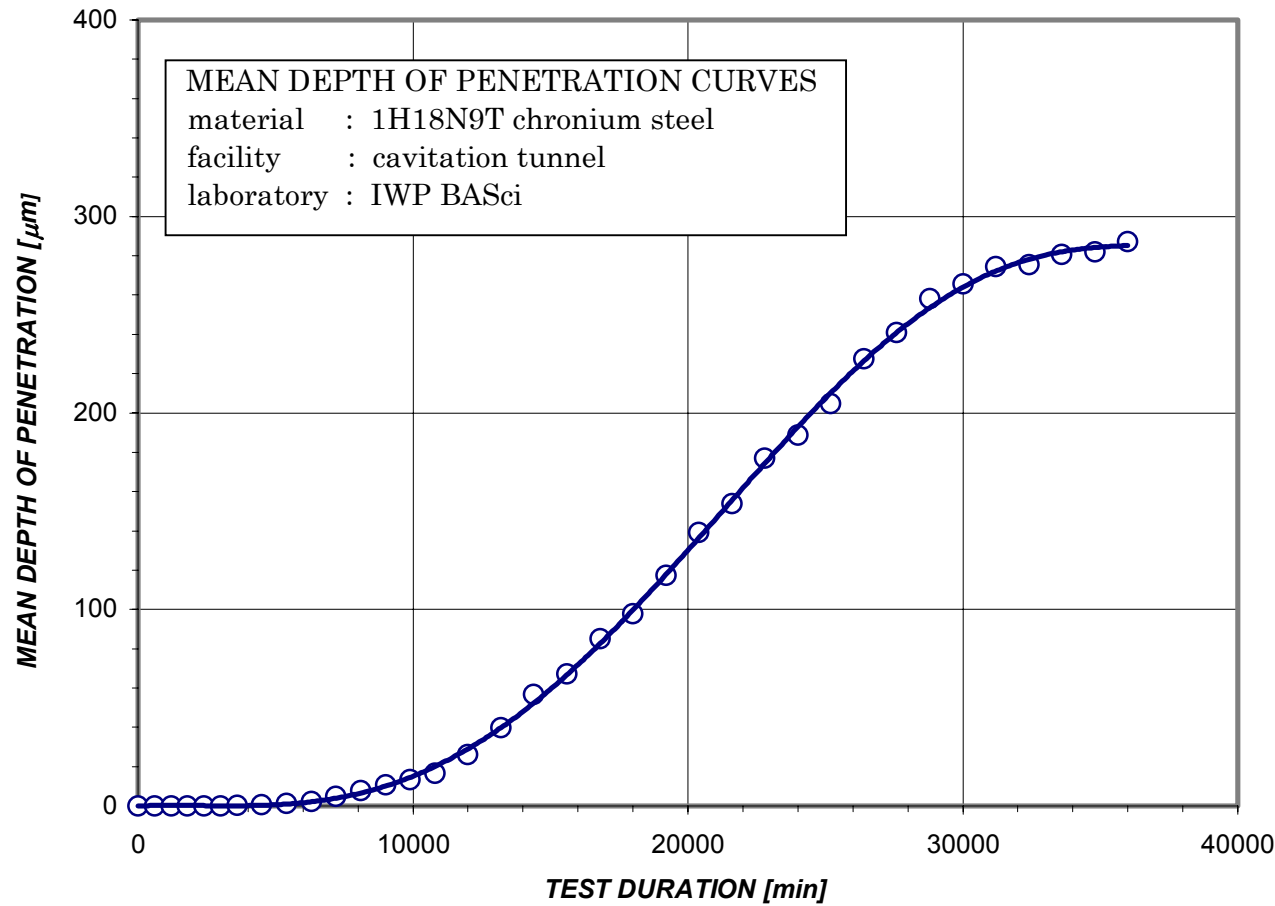


Enclosure: Eroded area curve





INTERNATIONAL CAVITATION EROSION TEST



Enclosure: Eroded area curve

