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.

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
**INTERNATIONAL CAVITATION EROSION TEST**

**Laboratory Results Summarisation**

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

**Facility:**  CAVITATION TUNNEL

- **cavitator:** cylindrical bolt  
- **specimen:** rectangular plate  
- **pressure:** 1260.00 kPa  
- **flow velocity:** 22.50 m/s  
- **impinged area:** 242.43 mm$^2$

**working liquid:** 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$^3$

<table>
<thead>
<tr>
<th>material</th>
<th>Test duration</th>
<th>Volume loss</th>
<th>Eroded area</th>
<th>Mean&amp;Max Depth of Penetration</th>
<th>Incubation period</th>
<th>MDPR</th>
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* gauge pressure
laboratory: IWP BASci
facility: cavitation tunnel

TEST DURATION [min]

CUMULATIVE VOLUME LOSS [mm³]

MEAN DEPTH OF PENETRATION [µm]

TEST DURATION [min]
INTERNATIONAL CAVITATION EROSION TEST

Laboratory Results Summarisation

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

Facility: CAVITATION TUNNEL

cavitator: cylindrical bolt
specimen: rectangular plate
pressure: 1260.00 kPa
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 PA2 aluminium alloy

<table>
<thead>
<tr>
<th>specimen no.</th>
<th>test duration</th>
<th>mass loss</th>
<th>volume loss</th>
<th>eroded area</th>
<th>Mean&amp;Max Depth of Penetration</th>
<th>Incubation period</th>
<th>MDPRmax</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>min</td>
<td>g</td>
<td>mm³</td>
<td>mm²</td>
<td>µm</td>
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<td>τinc</td>
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Mean values

|              | 1800          | 0.19845   | 73.69       | 242.4       | 303.9                      | 180              | 312     | 0.310  |

Enclosures

1. Photographs of eroded surface
2. Microsection photographs
3. Results of hardness and microhardness measurement
4. Eroded area curves
TOTAL VOLUME LOSS CURVES
material : PA2 aluminium
facility : cavitation tunnel
laboratory : IWP BASci

INTERNATIONAL CAVITATION EROSION TEST

TEST DURATION [min]
VOLUME LOSS [mm³]

Material: PA2 aluminium
Facility: Cavitation tunnel
Laboratory: IWP BASci
MEAN DEPTH OF PENETRATION CURVES
material: PA 2 aluminium
facility: cavitation tunnel
laboratory: IWP IWP BASci

INTERNATIONAL CAVITATION EROSION TEST

MEAN DEPTH OF PENETRATION [µm]

TEST DURATION [min]

MEAN DEPTH OF PENETRATION RATE [µm/min]

TEST DURATION [min]
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 \( H_{125} \) microhardness measurement indicated

Microsection taken from specimen section (b-b) in the zone of intense erosion showing local values of \( H_{125} \) microhardness at the surface and the average values at lower layers

\[ H_m = \text{Average value from 10 microhardness measurements in each points} \]

Base material: 61.5 - 62.8

CT 175
Enclosure 3: Results of hardness and microhardness measurement (continued)

HARDNESS (according to Vickers)

Loading force: 5 kG (HV₅)
Units applied: kG/m²

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<thead>
<tr>
<th>Measurement point</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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<th>15</th>
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<td>58.8</td>
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</table>

Enclosure 4: Eroded area curves

ERODED AREA CURVES
material : PA 2 aluminium
facility : cavitation tunnel
laboratory : IWP BASci

![Eroded Area Curves Graph]

CT 176
Laboratory: INSTITUTE OF WATER PROBLEMS OF THE BULGARIAN ACADEMY OF SCIENCES
SOFIA, Bulgaria

Facility: CAVITATION TUNNEL

cavitator: cylindrical bolt
specimen: rectangular plate
pressure: 1260,00 kPa
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 °C ÷ 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

<table>
<thead>
<tr>
<th>specimen no.</th>
<th>test duration</th>
<th>mass loss</th>
<th>volume loss</th>
<th>eroded area</th>
<th>Mean&amp;Max Depth of Penetration</th>
<th>Incubation period</th>
<th>MDPR_{max}</th>
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Enclosure
Eroded area curve
TOTAL VOLUME LOSS CURVES
material : M63 single phase brass
facility : cavitation tunnel
laboratory : IWP BASci
INTERNATIONAL CAVITATION EROSION TEST

MEAN DEPTH OF PENETRATION CURVES
material: M63 single phase brass
facility: cavitation tunnel
laboratory: IWP BASci.

TEST DURATION [min]

MEAN DEPTH OF PENETRATION [µm]

MEAN DEPTH OF PENETRATION RATE [µm/min]

TEST DURATION [min]
Enclosure: Eroded area curve

ERODED AREA CURVES
material : M63 single phase brass
facility : cavitation tunnel
laboratory : IWP BASci
INTernational cAVITATION Erosion test

Laboratory Results Summarisation

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

Facility: CAVITATION TUNNEL

cavitator: cylindrical bolt
specimen: rectangular plate
pressure: 1260.00 kPa
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: E04 Armco iron

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<th>volume loss</th>
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TOTAL VOLUME LOSS CURVES
material : E04 Armco iron
facility : cavitation tunnel
laboratory : IWP BASci.
INTERNATIONAL CAVITATION EROSION TEST

MEAN DEPTH OF PENETRATION CURVES

Material: E04 Armco iron
Facility: Cavitation tunnel
Laboratory: IWP BASci.

CT 183
Enclosure: Eroded area curve

ERODED AREA CURVES
material: E04 Armco iron
facility: cavitation tunnel
laboratory: IWP BASci
# INTERNATIONAL CAVITATION EROSION TEST

## Laboratory Results Summarisation

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

### Facility:
**CAVITATION TUNNEL**

- **cavitator:** cylindrical bolt
- **specimen:** rectangular plate
- **pressure:** 1260.00 kPa
- **flow velocity:** 22.50 m/s
- **impinged area:** 242.43 mm$^2$

- **working liquid:** tap water, pH = 7.5, dissolved oxygen content: 5.8 mg/dm$^3$
  - temperature: 15°C ÷ 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

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<th>specimen</th>
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<th>volume loss</th>
<th>eroded area</th>
<th>Mean&amp;Max Depth of Penetration</th>
<th>Incubation period</th>
<th>MDPR$_{\text{max}}$</th>
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<td>mm$^2$</td>
<td>µm</td>
<td>min</td>
<td>min</td>
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**Enclosures**

**Eroded area curve**
INTERNATIONAL CAVITATION EROSION TEST

TOTAL VOLUME LOSS CURVES
material : 45 carbon steel
facility : cavitation tunnel
laboratory : IWP BASci.

TEST DURATION [min]
VOLUME LOSS [mm$^3$]
MEAN DEPTH OF PENETRATION CURVES
material: 45 carbon steel
facility: cavitation tunnel
laboratory: IWP BASci

INTERNATIONAL CAVITATION EROSION TEST

TEST DURATION [min]

MEAN DEPTH OF PENETRATION [µm]

TEST DURATION [min]

MEAN DEPTH OF PENETRATION RATE [µm/min]
Enclosure: Eroded area curve

ERODED AREA CURVES
material : 45 carbon steel
facility : cavitation tunnel
laboratory : IWP BASci

TEST DURATION [min]
ERODED AREA [mm$^2$]
INTERNATIONAL CAVITATION EROSION TEST
Laboratory Results Summarisation

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

Facility: CAVITATION TUNNEL

cavitator: cylindrical bolt
specimen: rectangular plate

pressure: 1260.00 kPa
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 °C to 17 °C
chlorides - 32.77 mg/dm³
sulphates - 43.88 mg/dm³
iron - 5.80 mg/dm³
turbidity - 14.00 mg/dm³

Material: 1H18N9T acid resistant steel

<table>
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<th>specimen</th>
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<th>volume loss</th>
<th>eroded area</th>
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<th>Incubation period</th>
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<tbody>
<tr>
<td>no.</td>
<td>min</td>
<td>g</td>
<td>mm³</td>
<td>mm²</td>
<td>µm</td>
<td>µm</td>
<td>min</td>
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<td>287.3</td>
<td>-</td>
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Enclosures
Eroded area curve
TOTAL VOLUME LOSS CURVES
material: 1H18N9T chromium steel
facility: cavitation tunnel
laboratory: IWP BASci
INTERNATIONAL CAVITATION EROSION TEST

MEAN DEPTH OF PENETRATION CURVES
material : 1H18N9T chromium steel
facility : cavitation tunnel
laboratory : IWP BASci

TEST DURATION [min]

MEAN DEPTH OF PENETRATION [μm]

MEAN DEPTH OF PENETRATION RATE [μm/min]

TEST DURATION [min]
Enclosure: Eroded area curve

![Graph showing eroded area curve]

- **Material:** 1H18N9T chromium steel
- **Facility:** Cavitation tunnel
- **Laboratory:** IWP BASci