



# LABORATÓRIO DE ENSAIOS DE MATERIAL DE IRRIGAÇÃO (LEMI)



**Instituto Nacional**  
de Ciência e Tecnologia  
**Engenharia da Irrigação**

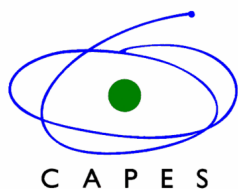
**Antonio Pires de Camargo**  
*Quality Manager – LEMI*  
*Associated Researcher – INCT-EI*





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Engenharia da Irrigação

# Organization Infrastructure of Labs



Universidade de São Paulo  
(USP)



Escola Superior de Agricultura  
"Luiz de Queiroz" (ESALQ)



Departamento de  
Engenharia de  
Biosistemas (LEB)



Instituto Nacional de  
Ciência e Tecnologia -  
Engenharia da Irrigação  
(INCT-EI)

Hydraulics Lab  
(360 m<sup>2</sup>)

Soil-Water Lab  
(180 m<sup>2</sup>)

Water Quality Lab  
(120 m<sup>2</sup>)

Irrigation Lab



Laboratório de Ensaio  
de Material de Irrigação





- ***Directors***

- José Antônio Frizzone (ESALQ/USP) – Coordinator
- Marcos Vinicius Folegatti (ESALQ/USP) – Vice-Coordinator
- Rubens Duarte Coelho (ESALQ/USP)
- Tarlei Arriel Botrel (ESALQ/USP)
- Manoel Valnir Júnior (IFCE/LEEI)

- ***3 International Advisors***

- Bruno Molle (CEMAGREF – France)
- José Maria Tarjuelo (UCLM – Spain)
- Luciano Mateos (IAS/CSIC – Spain)

- ***National Advisor***

- Edson Eiji Matsura (UNICAMP)

- ***18 Associated Researchers***

- ESALQ/USP, INOVAGRI, LEEI/IFCE, UFG, UEM, UFPel

- ***National partnership laboratory***

- Laboratório de Ensaios em Equipamentos de Irrigação – LEEI/IFCE

- ***Director (Top Management)***
  - José Antônio Frizzone (INCT-EI / ESALQ)
- ***Quality Manager***
  - Antonio Pires de Camargo (INCT-EI / ESALQ)
- ***Technical Manager***
  - Osvaldo Rettore Neto (INCT-EI / UFPel)
- ***Testing Staff***
  - Marinaldo Ferreira Pinto (INCT-EI / ESALQ)
  - Antonio Pires de Camargo (INCT-EI / ESALQ)



- ***Accredited tests***

- Laboratório de Ensaios de Material de Irrigação (LEMI)
- ABNT NBR ISO/IEC 17025:2005
- Certificate N<sup>o</sup> CRL 0549 (CGCRE/INMETRO)
- From March 30, 2012 to March 30, 2016

- ***General tests, researches, and development***

- Instituto Nacional de Ciência e Tecnologia em Engenharia da Irrigação (INCT-EI)
- Departamento de Engenharia de Biosistemas (LEB/ESALQ)



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# ACCREDITED TESTS





# Accredited Tests Rotating Sprinklers



- **Tests**

- Uniformity of flow rate
- Uniformity of distribution
- Height of water jet
- Radius determination

- **Standards**

- ABNT NBR ISO 7749-1:2000 (ISO 7749-1:1995 – Agricultural irrigation equipment – Rotating Sprinklers – Part I)
- ASAE S.398.1 MAR1985 (R 2007) – Procedure for sprinkler testing and performance

# Accredited Tests Rotating Sprinklers



- **Constraints**



1) Height of water jet  $\leq 5\text{m}$

2) Radius  $\leq 18\text{ m}$

3) Certified Elettromagnetic  
flowmeters:

a)  $D=4\text{ mm}$  ;  $Q_{\text{max}} = 0.09\text{ m}^3\text{ h}^{-1}$

b)  $D=10\text{ mm}$  ;  $Q_{\text{max}} = 0.5\text{ m}^3\text{ h}^{-1}$

c)  $D=25\text{ mm}$  ;  $Q_{\text{max}} = 4\text{ m}^3\text{ h}^{-1}$

d)  $D=38\text{ mm}$  ;  $Q_{\text{max}} = 10\text{ m}^3\text{ h}^{-1}$





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# Accredited Tests Microsprinklers



- **Tests**

- Uniformity of flow rate
- Performance characteristics (Flow rate as a function of inlet pressure)

- **Standards**

- ABNT NBR 15084:2004 (Based on ISO 8026:1995 - Agricultural irrigation equipment - Sprayers - General requirements and test methods)



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# Accredited Tests Microsprinklers

- *Microsprinklers' bench*





# Accredited Tests

## Emitters and emitting pipe



- **Tests**

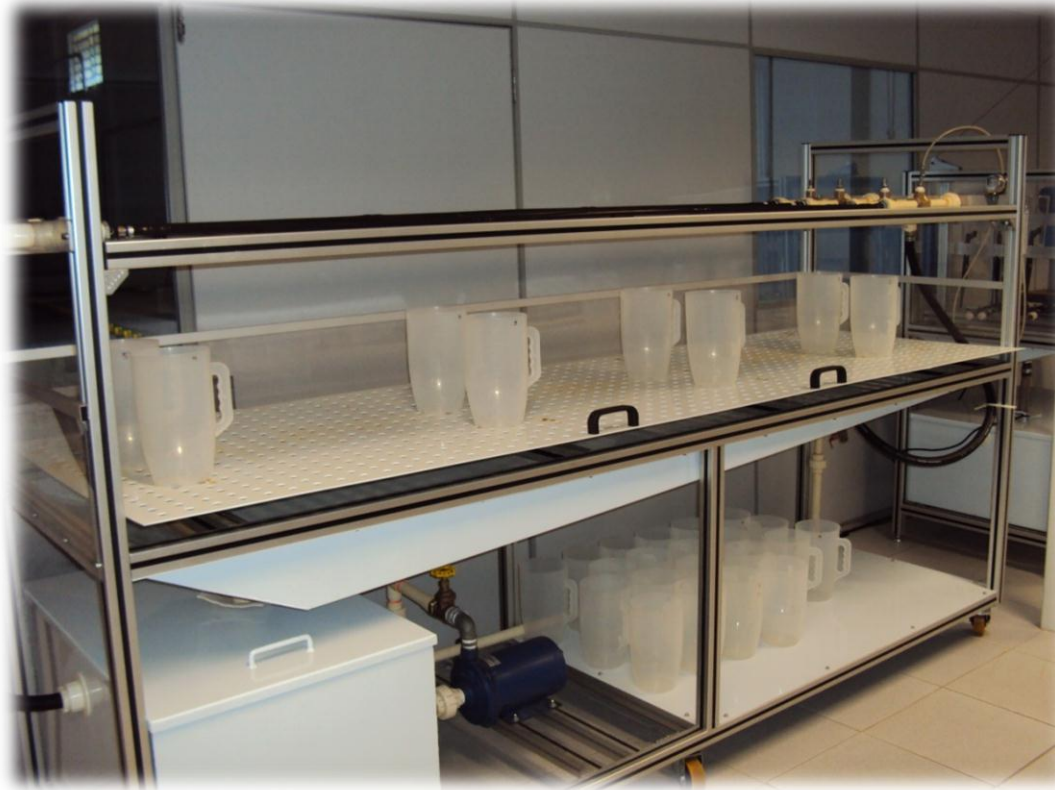
- Uniformity of flow rate
- Performance characteristics (Flow rate as a function of inlet pressure)
- Determination of emitter/emitting unit exponent

- **Standards**

- ABNT NBR ISO 9261:2006 (ISO 9261:2004 - Agricultural irrigation equipment - Emitters and emitting pipe - Specification and test methods)

# Accredited Tests

## Emitters and emitting pipe



4 lines

Length of testing samples = 2.5 m



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# GENERAL TESTS AND RESEARCHES

# General Tests Sprinklers

- *Water distribution tests*



# General Tests Microsprinklers

- *Water distribution tests*



- *Emitter clogging tests*



### *Bench*

- 4 Modules
- Line length: 11 m
- Up to 126 lines / module

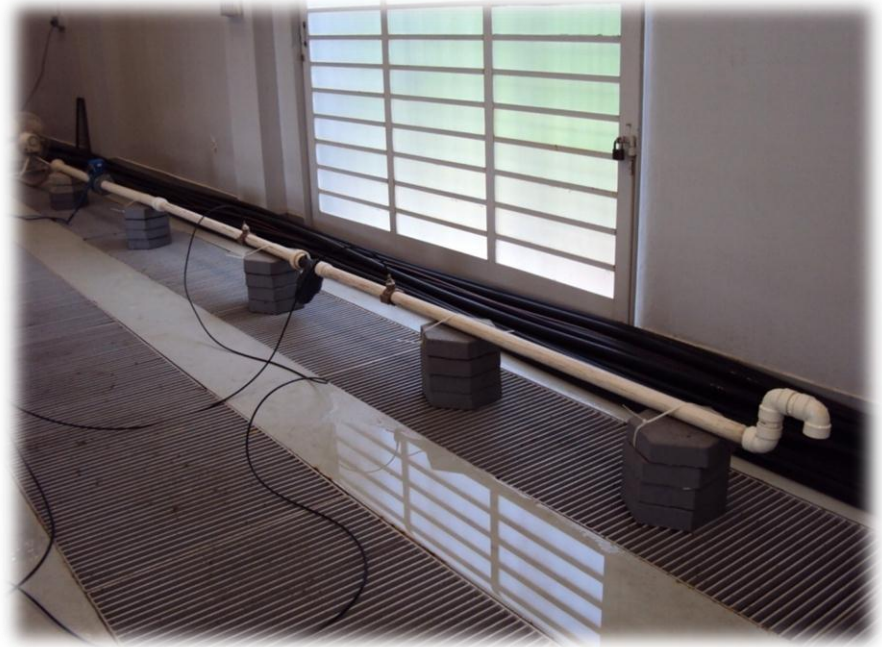
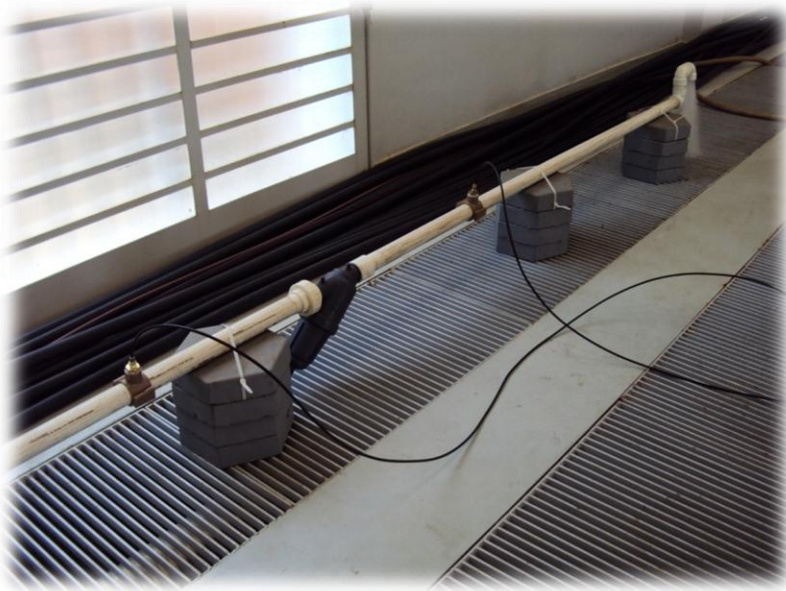




# General Tests

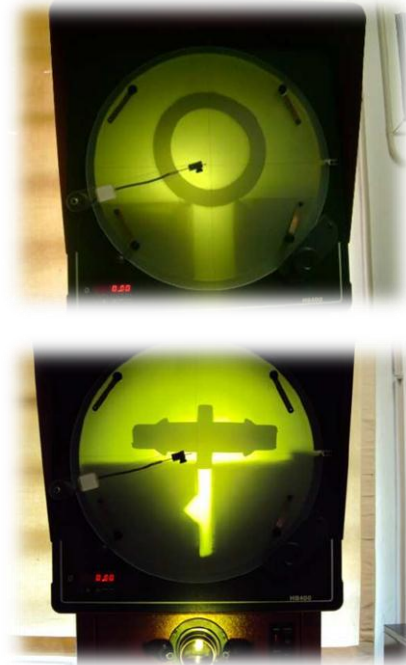
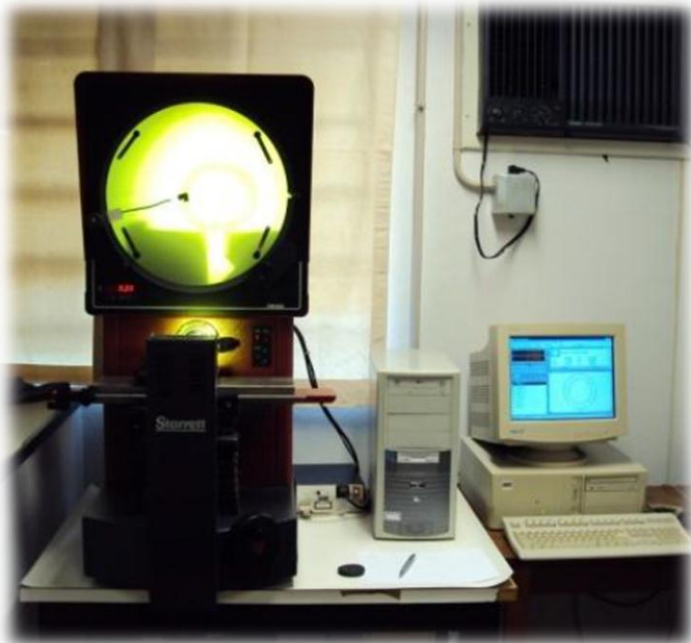
## Screen and disc filters

- *Local head loss*
- *Efficiency*



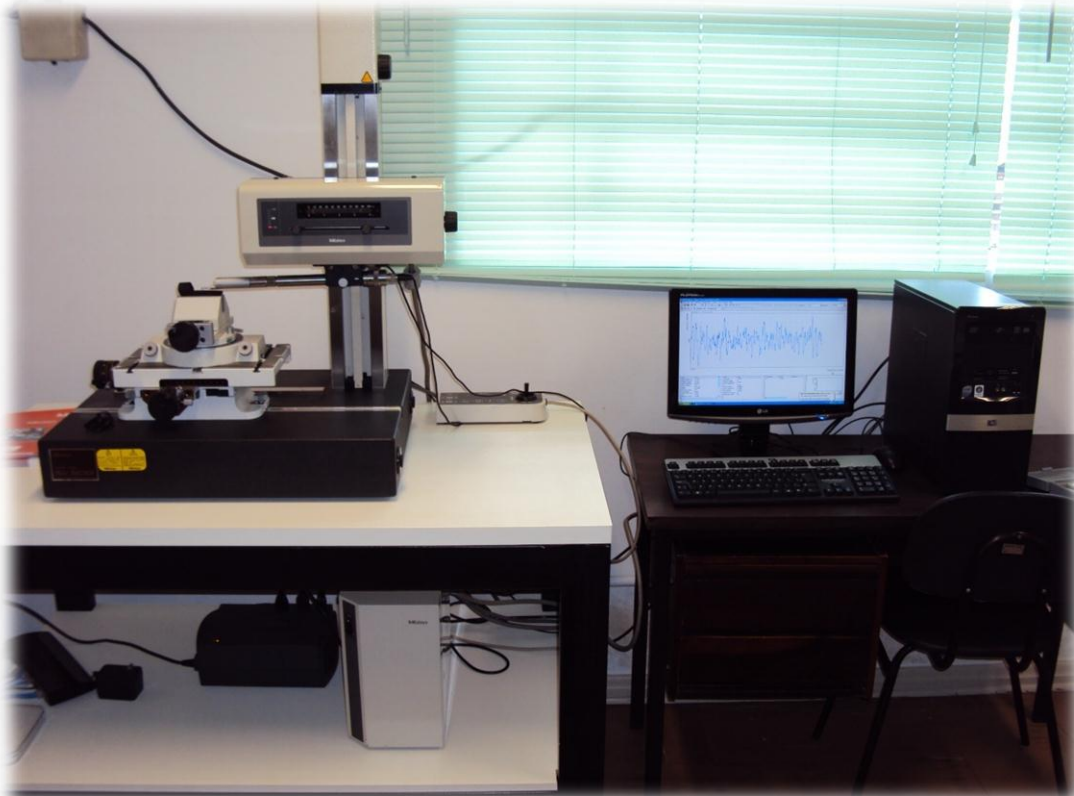
# General Tests Dimensional

- *Measurement of dimensions:  
pipes, connectors, sprinklers'  
nozzles,...*



Horizontal Benchttop Optical Comparator - Starret HB400

- *Determination of roughness height ( $\epsilon$ )*



Surface roughness testing system – Mitutoyo SV600

# General Tests Dimensional



Laser scan micrometer  
Mitutoyo LSM503S



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# General Tests / Researches

- *Hydraulics Laboratory*





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# DEVELOPMENT

- *Rubber porous hose for microirrigation*



*The raw material comes from used tires.  
Collaboration with Samaritá Indústria e Comércio*



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# PERSPECTIVES / CONCLUSIONS





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# Perspectives / Conclusions

## LEMI



- ***Expansion of accredited activities' scope***
  - Durability and resistance tests – sprinklers (ABNT NBR ISO 7749-1:2000)
  - Durability and resistance tests – micros sprinklers (ABNT NBR ISO 15084:2004)
  - Pressure-regulating valves (ISO 10522:1993)



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# Perspectives / Conclusions

## LEMI



- ***International Network of Irrigation Testing (INITL)***

- Participation in interlaboratory comparison
- Improvement of tests procedures
- Assure the quality of results
- Participation on standards development



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**THANK YOU!**

**LABORATÓRIO DE ENSAIOS DE MATERIAL DE  
IRRIGAÇÃO (LEMI)**

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