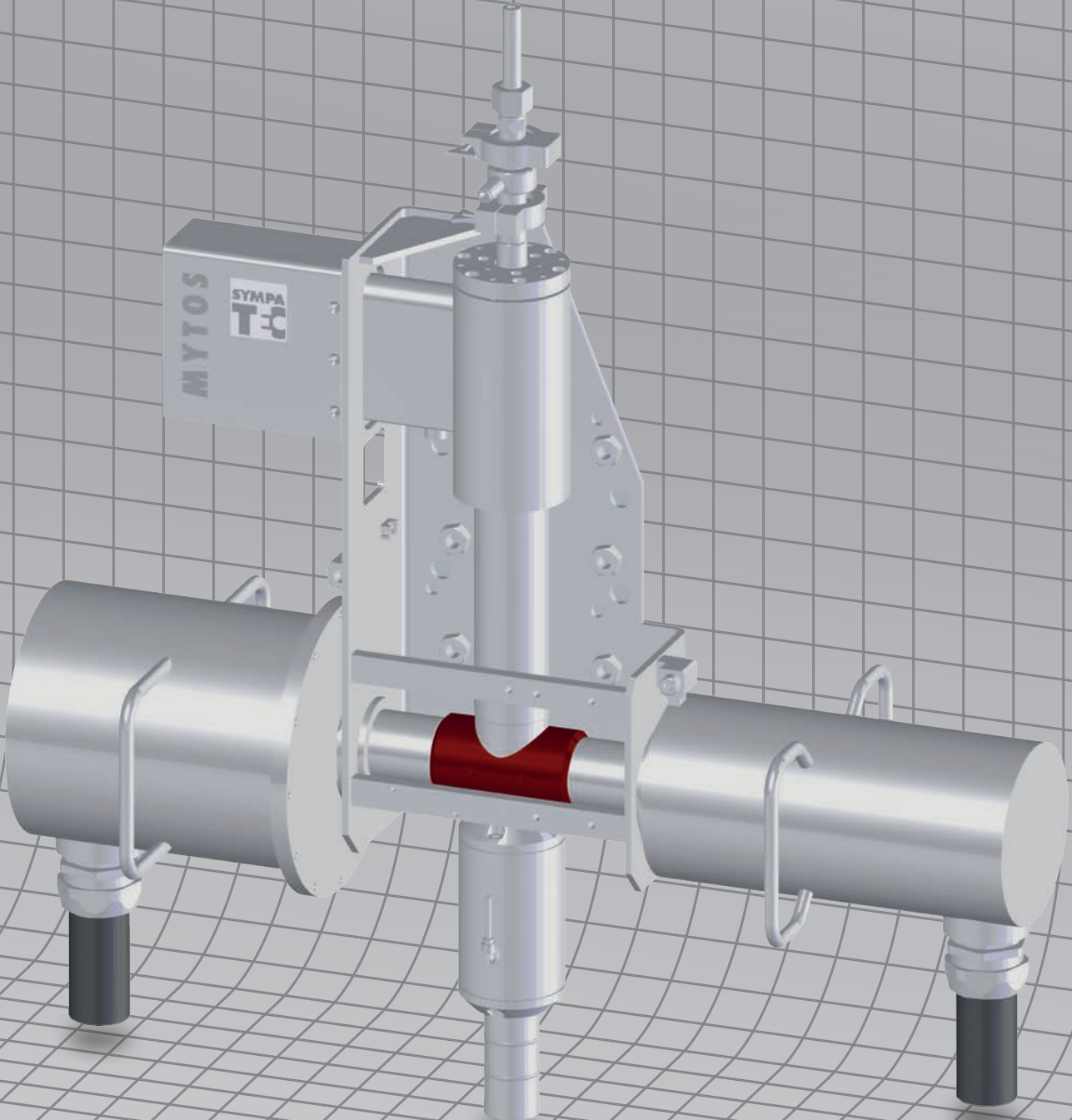


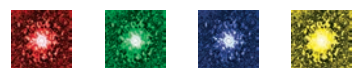
MYTOS | TWISTER & Co. | Laser Diffraction  
Particle Measurement | Process | Dry  
Size and Distribution | 0.25  $\mu\text{m}$  to 3,500  $\mu\text{m}$



Technical Specifications



Sympatec develops, manufactures, sells, services and supports a range of best instruments for particle size and shape analysis in laboratory and process applications for customers worldwide. With continuous innovations Sympatec makes a prominent contribution to **laser diffraction**, **image analysis**, **ultrasonic extinction** and **photon cross-correlation spectroscopy**.



# MYTOS | MYTIS

## HELOS & RODOS | HELOS & GRADIS

### in-line Laser Diffraction

#### Technical Specifications

#### Laser Diffraction Sensor for in-, on- and at-line Particle Size Analysis

#### Sensor | Measuring Ranges | Detector | Dispersing Systems | Configurations | Process

Sensor	MYTOS	MYTIS
Label	MYTOS	MYTIS
Overall measuring range	0.25 - 3,500 µm	0.5 - 3,500 µm
Measuring range modules	7	2
Dispersing systems	RODOS	GRADIS

#### Measuring principle

Laser diffraction	Forward scattering in parallel beam – classic optical FOURIER set up (DIN 13320) – encapsulated measuring zone with shielded aerosol input (sheath flow)
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#### Light source

Helium-neon laser	λ=632.8 nm (red), P <sub>out</sub> =5 mW	
Protection class	1	
Beam diameter	R2   R3   R4	2,2 mm
	R5   R6M	8,8 mm
	R6   R7	26,0 mm

#### Measuring ranges and optics

Discrete measuring ranges with highest precision and resolution.

		Focal length	X <sub>min</sub> , CL <sub>min</sub>  CL <sub>max</sub> *-	X <sub>max</sub>
MYTOS	R2	(f=50 mm)	0.25   0.45 -	87.5 µm
	R3	(f=100 mm)	0.50   0.90 -	175.0 µm
	R4	(f=200 mm)	0.50   1.80 -	350.0 µm
	R5	(f=500 mm)	0.50   4.50 -	875.0 µm
	R6M	(f=500 mm)	0.50   9.00 -	1,750.0 µm
MYTIS	R6	(f=1,000 mm)	0.50   9.00 -	1,750.0 µm
	R7	(f=2,000 mm)	0.50   18.00 -	3,500.0 µm

\* Values indicate lower | upper limits of first class.

#### Detector and data acquisition

Multi-element detector	31 semi-circular segments (180°) for orientation-independent characterisation of even irregular shaped particles 3 centre elements for precise autofocus prior to every measurement and for continuous monitoring of optical concentration during measurement
Acquisition rate	2,000 diffraction patterns per second
Measuring time <sup>1</sup>	minimum 0,5 ms/measurement typical 30-60 s/measurement
Data processing	Desktop / Industrial PC, Laptop, Touch panel PC

#### Dry Dispersing Systems<sup>2</sup>

	Dispersing range	Sample amount per analysis
RODOS <sup>3</sup> (inside MYTOS)	0.25 - 3,500 µm	< 1 mg - 2,000 g
Injection disperser for finest, even cohesive powders		

GRADIS <sup>4</sup> (inside MYTIS)	0.5 - 3,500 µm	10 - 2,000 g
Gravity disperser for coarser, even fragile particulate systems		

#### System configurations MYTOS

in-line	MYTOS & TWISTER 100   150   200	
	pipe diameter	80 - 200 mm
	5 measuring ranges	R2 ... R6M
on-line	MYTOS R2 ... R6M   R6 ... R7   GMP	
	for pipe diameters	38 - 800 mm
at-line	7 measuring ranges	R2 ... R7
	MYTOS & VIBRI   GMP	
	automatic feeding	
	stationary unit	
	7 measuring ranges	R2 ... R7
	MYTOS & VIBRI Module   GMP	
	automatic feeding	
	mobile module	
	5 measuring ranges	R2 ... R6M

#### System configurations MYTIS

on-line or at-line	MYTIS & VIBRI   GMP	
	manual or automatic feeding	
	stationary or mobile unit	
	2 measuring ranges	R6   R7

#### Operational conditions MYTOS | MYTIS<sup>5,6</sup>

Product temperature	in-line	-20°C to 80°C
	on-line	-20°C to 150°C
Ambient temperature		-20°C to 40°C
Process pressure	standard	0.8 to 1.1/1.5 <sup>7</sup> bar absolute
	ATEX	0.8 to 1.1 bar absolute
Pressure bursts <sup>9</sup>	R2 ... R6M	(< 1 s) up to 10 bar
	R6   R7	(< 1 s) up to 8 bar
Protection class		IP64
Protection classes ATEX	gas, for zone 1	II 2G
	dust, for zone 20/21	II 1/2D
	dust, for zone 20/22	II 1/3D
	hybrid, for zone 1+20/1+21	II 2G1D/2GD

1) Process dependent 2) Recommended optical concentration for particle size analysis with dry dispersing units: c<sub>opt</sub>=5-15 %, ideally c<sub>opt</sub>=8-12 %. 3) Also applied for image analysis with PICTOS. 4) Also applied for image analysis with PICTIS.

5) The stated specifications are indicative and show the overall spectrum of possible configurations. Values of individual configurations are process dependent. 6) Certain characteristics are exclusive to special models only. 7) on-line/in-line installation

### Sampling Systems for Process

Powder | Meal | Sand | Grit | Granules

#### Sample Feeding and Process Coupling<sup>5</sup>

##### TWISTER<sup>6</sup>

Representative, dynamic sampler for installation in process pipes. Scanning the entire pipe cross section with adaptable sample size.<sup>8</sup>

Particle size range	0.25 - 3,500 µm	
Pipe diameter	50 - 800 mm	
Product temperature	-20°C to 150°C	
Ambient temperature	-35°C to 55°C	
Process pressure	standard	0.8 to 1.1/1.5 <sup>7</sup> bar absolute
	ATEX	0.8 to 1.1 bar absolute
	pressure bursts <sup>9</sup>	(< 1 s) up to 10 bar
Protection class	IP64	
Protection classes ATEX	gas, for zone 1	II 2G
	dust, for zone 20/21	II 1/2D
	dust, for zone 20/22	II 1/3D
	hybrid, for zone 1+20/1+21	II 2G1D/2GD

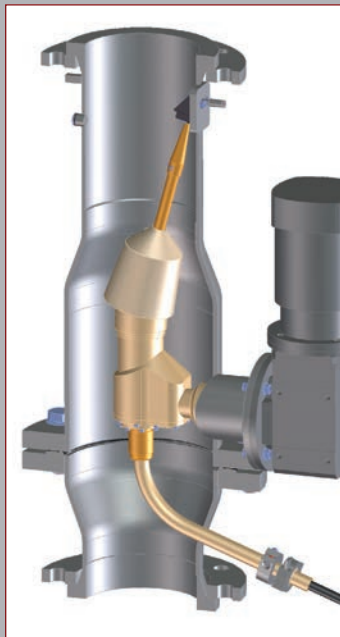
##### SCREWSAMPLER<sup>6</sup>

Representative screw sampling in down pipe<sup>8</sup>

Particle size range	0.25 - 1,750 µm
Pipe diameter	> 200 mm
Product temperature	-20°C to 80°C
Ambient temperature	-20°C to 40°C
Process pressure	0.8 to 1.1 bar absolute



TWISTER 50 ATEX | GMP on-line



TWISTER 150 on-line

##### L-Probes<sup>6</sup>

Compact sampler with blow-back unit (static L-probe) or with pivoting option (pneumatic pivoting probe)<sup>8</sup>

Particle size range	0.25 - 3,500 µm	
Pipe diameter	static probe	65 - 250 mm
	pivoting probe	150 - 200 mm
Product temperature	static probe	-20°C to 150°C
	pivoting probe	-20°C to 100°C
Ambient temperature	-35°C to 55°C	
Process pressure	standard	0.8 to 1.1 bar absolute
	ATEX	0.8 to 1.1 bar absolute
	pressure bursts <sup>9</sup>	(< 1 s) up to 10 bar
Protection class	static probe	n.a.
	pivoting probe	IP68
Protection classes ATEX	static probe	Ex II 1 GD c IIC TX
	pivoting probe	Ex II 1/3 GD c IIC 135°C (T4)

##### MIXER<sup>6</sup>

Static mixer for representative sampling behind a screw feeder or a feeding chute<sup>8</sup>

Particle size range	0.25 - 1,750 µm
Pipe diameter	60 mm
Mass flow rate	max. 400 kg/h
Product temperature	-20°C to 80°C
Ambient temperature	-20°C to 55°C
Protection class	n.a.

##### VIBRI<sup>6</sup>

Vibratory feeder for precise dosing. For adaptation to proprietary sampler or for manual feeding<sup>8</sup>

Particle size range	< 0.1 - 10,000 µm
Product temperature	0°C to 55°C
Ambient temperature	-10°C to 55°C
Protection class	IP20



MIXER on-line



Pivoting Probe on-line

8) Application-dependent industrial extraction unit required if sample is not to be reintroduced into process. Sample recovery may be employed by cyclonic separation. 9) Certified pressure shock resistance as an option

10) The stated specifications are indicative and display the overall spectrum of possible configurations. Values of individual configurations may vary. 11) External control box for MYTOS required, dimensions depending on specification: H 625 ... 1,200 / L 460 ... 975 / W 238 ... 386 mm; 25 ... 60 kg.

in-line Interfaces

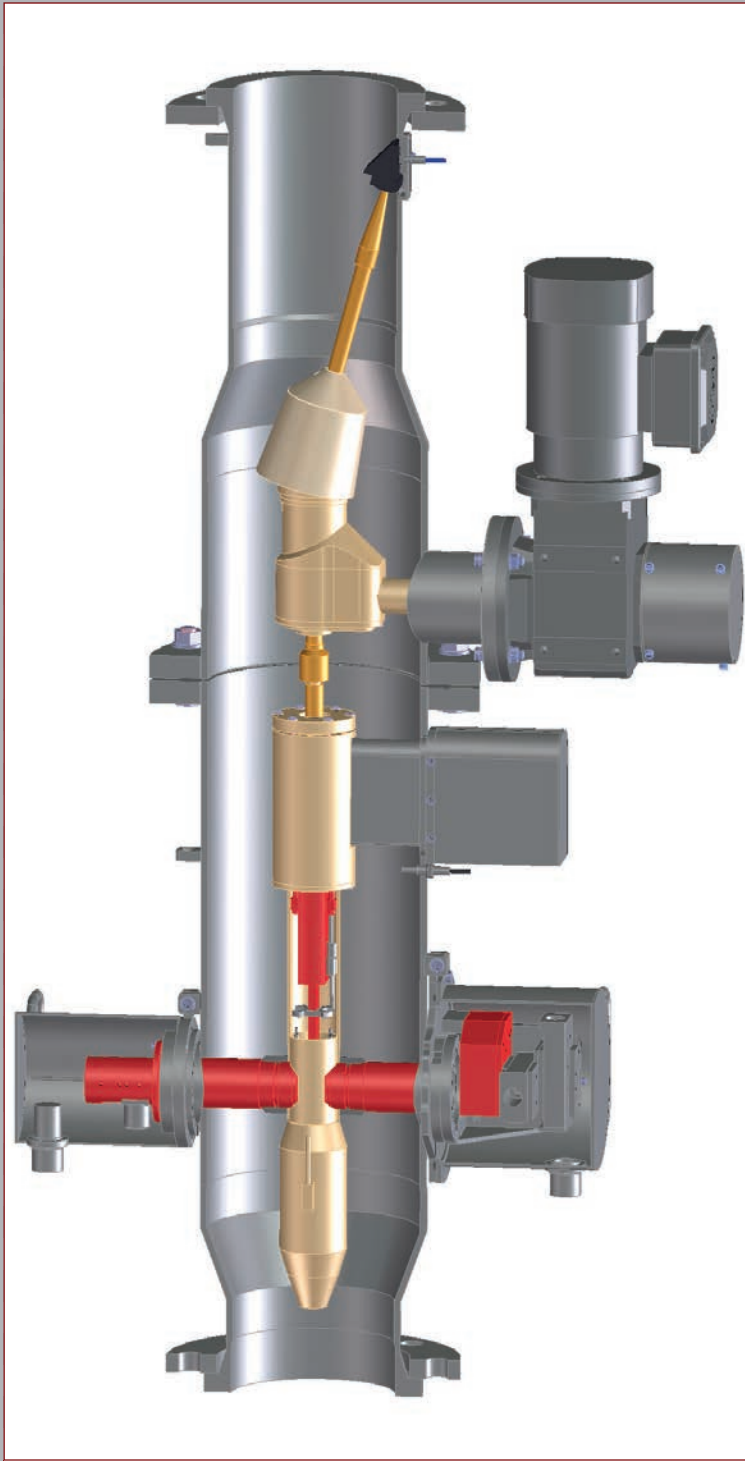
Systems for in-, on- and at-line Particle Size Analysis  
Dimensions | Weight | Supply

Dimensions and Weights <sup>10</sup>			
Sensors <sup>11</sup>		Dimensions H / L / W (mm) <sup>12</sup>	Weight (kg)
MYTOS & TWISTER	in-line		
	DN100	1,224 / 563 (704)* / 350	100 (99)*
	DN150	1,280 / 563 (704)* / 380	135 (134)*
	DN200	1,527 / 563 (704)* / 380	150 (149)*
MYTOS R2 ... R6M	on-line	717 / 563 (704)* / 300	30 (33)*
MYTOS R6 ... R7	on-line	880 / 860 / 348	45
MYTOS & VIBRI	at-line		* (...) ATEX models
	R2 ... R6M	936 / 563 / 300	38
	Compact	836 / 563 / 258	37
	Module <sup>13</sup>	1,052 / 996 / 326	150
	R6 ... R7	1,130 / 860 / 348	53
MYTIS & VIBRI <sup>13</sup>	at-line	1,363 / 870 / 720	190
Sampling systems and process coupling <sup>14</sup>			
TWISTER 50	DN50	458 / 370 / 231	8
TWISTER 100	DN100	689 / 525 (605)* / 311 (285)*	68 (64)*
TWISTER 150	DN150	784 / 580 (660)* / 340	105 (101)*
TWISTER 200	DN200	875 / 580 (660)* / 376	80 (76)*
TWISTER 250	DN250	1,000 / 610 (670)* / 395	95 (91)*
TWISTER ...	DN400 ... 800	H 1,421 ... 2,000 L 1,065 ... 1,400 W 695 ... 1,150	400 ... 600 * (...) ATEX models
MIXER		330 / 140 / 115	4
SCREWSAMPLER		250 / 600 / 80	3
Pivoting probe		167 / 135 / 650	16
Static L-probe		170 / 96 / 340	5

Power supply and Consumption		
	Power supply	Power consumption max.
MYTOS	90 ... 250 V @ 50-60 Hz	60 W
MYTOS & VIBRI   MYTIS & VIBRI	90 ... 250 V @ 50-60 Hz	70 W
TWISTER 50	90 ... 250 V @ 50-60 Hz	35 W
TWISTER 100 ... 250	115 / 230 V @ 50-60 Hz	600 W
TWISTER 400 ... 660	230 V @ 50-60 Hz	3,000 W
TWISTER 100 ... 660 ATEX	230 V @ 50-60 Hz	1,400 W

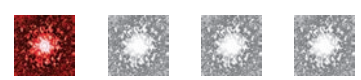
Compressed Air*		
	Air supply pressure	Air consumption
MYTOS   MYTOS & VIBRI	4 ... 6 bar	570 ... 870 NI/min
MYTIS & VIBRI	4 ... 6 bar	300 NI/min
TWISTER 50	5 ... 6 bar	25 NI/min
TWISTER 100 ... 250	2 ... 6 bar	25 NI/min

\* Quality acc. ISO 8573-1 dust / water / oil content Class 1 / 3 / 1



MYTOS & TWISTER 150 in-line

12) With in-line solutions H determines installation height in process line. 13) including control box and rack  
14) External control box for TWISTER required, dimensions depending on specification: H 490 ... 1,200 / L 430 ... 975 / W 238 ... 386 mm; Weight 13 ... 75 kg.





## Systems for Particle Size Analysis

Evaluation | Quality | Software | Peripherals

Evaluation modes	
FREE	Fraunhofer Enhanced Evaluation (Fraunhofer Diffraction, parameter free)
MIEE <sup>15</sup>	Mie Extended Evaluation (Mie Scattering, deploying the complex refractive index)

Quality of measuring results		
Repeatability <sup>16</sup>	$\sigma < 0.3 \%$	typical, dry measurement <sup>17</sup>
Comparability <sup>18</sup>	$\sigma < 1.5 \%$	mean relative standard deviation of median ( $x_{50}$ )
	$ \Delta x_{50}  < 2.5 \%$	maximum relative deviation

Quality assurance system	
Certification	Standardised test procedure
Reference material	SiC-F1,200 ( $x_{50} \approx 4.5 \mu\text{m}$ )
	SiC-P600 ( $x_{50} \approx 27 \mu\text{m}$ )
	SiC-P80 ( $x_{50} \approx 260 \mu\text{m}$ )
	SiC-P50 ( $x_{50} \approx 430 \mu\text{m}$ )
Validation	Qualification of the measuring system within a validated process according to FDA regulations

Software	
PAQXOS	PC or remote control of application in terms of sensor, dispersing unit and sample feeding
Control and evaluation software for particle size analysis	Evaluation – Fraunhofer Enhanced Evaluation (FREE) – Mie Extended Evaluation (MIEE) <sup>13</sup> – Mean values and standard deviations – Presentation of results based on user-defined reports and templates – diagrams (distribution curves, trend graphs) – tables – characteristic values
	Step-by-step wizard for quick & successful measurements Intuitive SOP management User-friendly, individual user interface

Compliance	
ISO 13320	The ISO standard requirements concerning "Particle size analysis - Laser diffraction methods" are met and in parts outperformed.
FDA 21 CFR Part 11	The compliance to FDA rule standards concerning electronic records and electronic signatures is provided.

Computer specifications	
Operating system <sup>19</sup>	Microsoft® Windows® 10 Professional (64 Bit)
Hardware specifications <sup>20</sup>	Up-to-date desktop PC, e.g., Intel® Core™ i7-8700, min. 3.2 GHz, 8 GB RAM, 12 MB Cache, SSD PCIe 512 GB, Intel® HD Graphics 630, DVD±RW
Display	27" Full HD (2,560 x 1,440 px)
Data transfer	Ethernet LAN connection (100 MBit/s), min. CAT5 FOL-LAN using media converters
Connectivity to distributed control system	Modbus® RTU, Modbus® TCP, Profibus®, OPC, TCP/IP, FTP, analogue SPS signals, MQTT



MYTOS & TWISTER 150 on-line



MYTOS & TWISTER 150 in-line



MYTIS & VIBRI GMP at-line



MYTOS & VIBRI Module at-line

15) optional 16) The given values are valid for measurements with reference material SiC P600 related to the  $x_{50}$ -value. 17) Repeated dry measurement of riffled sample. 18) system-to-system reproducibility 19) Microsoft® Windows® 7 Professional (64 Bit) supported.

20) Sympatec reserves the right to supply equivalent or better specified personal computers.





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