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1. nl.results4care.OxygenSaturation-v0.83

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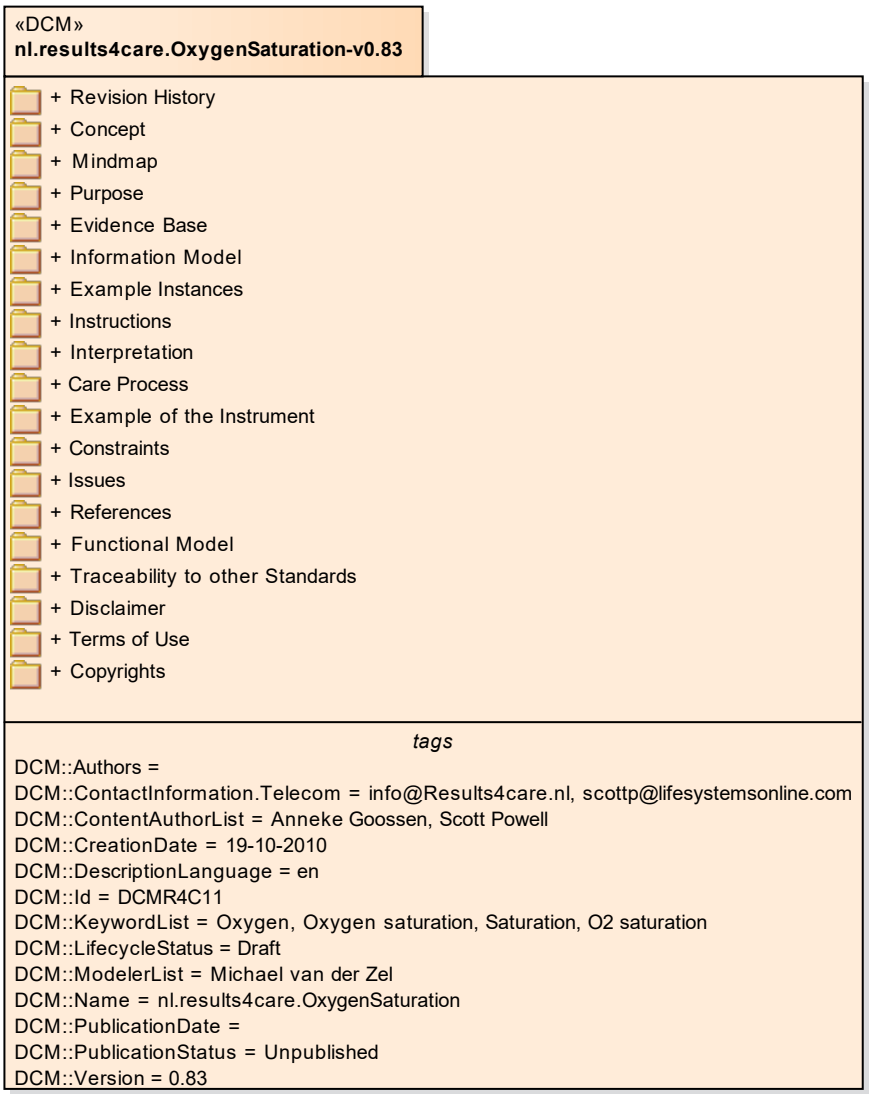


1.1 Revision History

- Version 0.1 till version 0.82 is development, review and adjustments of the DCM. Version 0.82 is developed in Enterprise Architect. (oct-2010)

1.2 Concept

The observation of oxygen saturation by transcutaneous measurement.

1.3 Mindmap

1.4 Purpose

The purpose of the non invasive measurement and monitoring of oxygen saturation is to measure the amount of oxygen at the tissue level. Measuring oxygen saturation is nearly universal in the management of critically ill patients in the intensive care unit (ICU) and during surgery. The measurement of oxygen saturation detects hypoxia, prevents hyperoxia and reduces the frequency of blood gas analysis (Perkins, 2003).

1.4.1 Purpose of DCM

1.4.2 Reason for DCM use

*Beschrijf de **reden** waarom de schaal, het instrument, de observatie of de actie van belang is. Op deze plaats wordt dit kort en krachtig beschreven. Hier wordt veelal verwezen naar (landelijke) richtlijnen, wetgeving of good practice. Indien iets specifiek voor persoon A of organisatie B wordt uitgewerkt, wat goed mogelijk is, wordt dit uitdrukkelijk vermeld.*

Bijvoorbeeld: Het meten van het bewustzijn is belangrijk voor het stellen van de diagnose en de prognose en voor het volgen van de toestand, zodat een eventuele verdere daling van het bewustzijn tijdig geconstateerd kan worden en maatregelen kunnen worden getroffen.

1.4.3 Patient population

*Beschrijf bij welke **groep cliënten** de schaal, het instrument, de observatie of actie wenselijk, nodig en/of verplicht is.*

Bijvoorbeeld: Voor volwassenen en kinderen zijn er aparte gebruiksvoorschriften. Dit model beschrijft het gebruik van de GCS voor volwassenen.

1.5 Evidence Base

In blood, there are red blood cells responsible for transporting oxygen to the tissues. Inside red blood cells is *hemoglobin* (Hb) that binds oxygen in the lungs and releases oxygen in the tissues.
The arterial oxygen saturation, or simply saturation of O_2 saturation, is a measure of the amount of oxygen bound to hemoglobin in red blood cells in the arteries. The saturation is expressed as a percentage and in healthy individuals is more than 95%.
The arterial oxygen saturation is also expressed as SpO_2. Measuring the arterial oxygen saturation can happen in two ways:

- arterial blood gas analysis: This method requires an arterial blood sample and is quite expensive;

transcutaneous measurement with a pulse oximeter: This method is simple and less expensive (RDSM, 2006-2008).

Oxygen saturation is an indicator of the percentage of hemoglobin saturated with oxygen at the time of measurement.
SpO_2 monitors have been widely used since the mid to late part of the 1980s, and the results have been considered the "fifth vital sign". (Castillo, 2008, VICP, 2008).
The result is obtained by a pulse oximeter, which uses a light sensor that contains two sources of light (red and infrared): also called the probe. This light is absorbed by hemoglobin and sent through the tissue to a photo sensor. The amount of light transmitted through the tissue is then converted to a digital value which reflects a percentage of hemoglobin saturated with oxygen.
Oxygen saturation values obtained by a pulse oximeter (SpO_2) are part of a full evaluation of the oxygen status of a patient, but are not suitable for measurement of arterial oxygen partial pressure (PaO_2) or breathing.
The accuracy of SpO_2 measurements requires the consideration of a number of physiological variables. These include the following patient variables (Schutz, 2001):

- Hemoglobin level
- Arterial blood flow in the vascular system

Temperature of the instrument or the environment where the oximeter is located
The oxygenation ability of the patient

- Percentage of inspired oxygen

Evidence of improper ventilation perfusion

- Amount of ambient light picked up by the meter

Venous return at the location of measurement

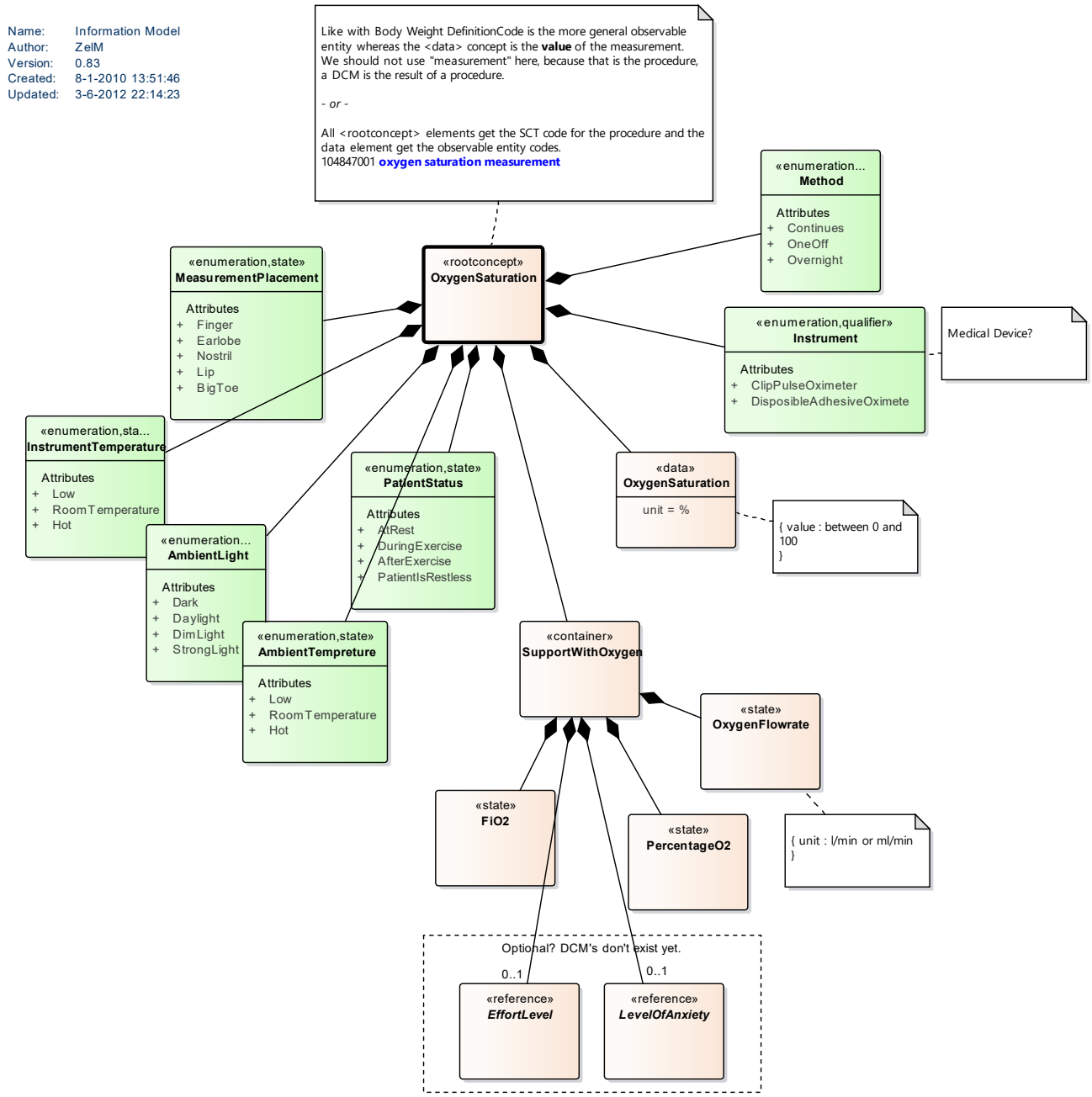
In addition, the measurement is also disturbed by (NVICV - VICP, 2008):
Dislocation of the sensor
Decreasing peripheral circulation, with perfusion indicator PFI <0.3. (PFI> 1 is normal)
Carbon monoxide poisoning,
Shivering, restlessness or excessive movement,
Interference with light absorption, e.g. high bilirubin,
Saturation overestimated in the presence of carboxyhemoglobin,
Saturation underestimated in the presence of methemoglobin

Any discoloration of the nail bed can affect the transmission of light and can result in an artificially elevated (decreased?) SpO_2 value. Pulse oximeters are unable to distinguish between oxygen and carbon monoxide bound to hemoglobin. Measurements that are made in the presence of carbon monoxide will be falsely elevated. Pulse oximetry should therefore never be used in the suspected presence of carbon monoxide exposure. An arterial blood gas reading should always be done in such cases. A pulse oximeter should also never be used during a cardiac arrest situation due to the extreme limitations of blood flow (Schutz, 2001).

1.6 Information Model

OxygenSaturation **has a** Method
OxygenSaturation **has a** PatientStatus
OxygenSaturation **has a** MeasurementPlacement
OxygenSaturation **has a** Instrument
OxygenSaturation **has a** InstrumentTemperature
OxygenSaturation **has a** SupportWithOxygen
SupportWithOxygen **has a** PercentageO2
SupportWithOxygen **has a** OxygenFlowrate
SupportWithOxygen **has a** FiO2
SupportWithOxygen **has 0 or 1** LevelOfAnxiety

SupportWithOxygen **has 0 or 1** EffortLevel
OxygenSaturation **has a** AmbientLight
OxygenSaturation **has a** AmbientTempreture
OxygenSaturation **has a** OxygenSaturation
Method **is a** *coded description*
PatientStatus **is a** *coded description*
MeasurementPlacement **is a** *coded description*
Instrument **is a** *coded description*
InstrumentTemperature **is a** *coded description*
PercentageO2 **is a** *physical quantity*
OxygenFlowrate **is a** *physical quantity*
FiO2 **is a** *physical quantity*
AmbientLight **is a** *coded description*
AmbientTempreture **is a** *coded description*
OxygenSaturation **is a** *physical quantity*



«reference»	EffortLevel
Definitie	state

Datatype	
Opties	

«state»	FiO2
Definitie	Inspired oxygen fraction v / h total inhaled gas mixture
Datatype	
Opties	

«reference»	LevelOfAnxiety
Definitie	state
Datatype	
Opties	

«state»	OxygenFlowrate	
Definitie	Flow rate of the inhaled oxygen	
Datatype		
Opties		
Constraint	unit	l/min or ml/min

«rootconcept»	OxygenSaturation	
Definitie		
Datatype		
DCM::DefinitionCode	SCT:103228002:blood oxygen saturation	
Opties		

«data»	OxygenSaturation	
Definitie		
Datatype		
DCM::DefinitionCode.2	LOINC:2710-2 Oxygen saturation	
DCM:DefinitionCode.1	SCT:431314004: peripheral oxygen saturation	
Opties		
Constraint	value	between 0 and 100
Constraint	unit	%

«state»	PercentageO2
Definitie	Percentage of inhaled oxygen
Datatype	
Opties	

«container»	SupportWithOxygen
Definitie	
Datatype	
Opties	

«state»	AmbientLight	
Definitie	The strength of the ambient light can influence the measurement.	
Datatype		
Opties	Dark	During the night or in a dark dimmed room
	Daylight	During the day, with no additional light
	DimLight	The patient room is illuminated, but the light is dimmed
	StrongLight	The room of the patient is strongly illuminated

«state»	AmbientTempreture	
Definitie	The temperature of the environment can influence the measurement.	
Datatype		
Opties	Low	The ambient temperature is colder than usual
	RoomTemperature	The ambient temperature is equal to the usual room temperature
	Hot	The ambient temperature is warmer than usual

«qualifier»	Instrument	
Definitie	The instrument by which the oxygen is measured.	
Datatype		
DCM::DefinitionCode	SCT:59181002: oxygen analyzer	
Opties	ClipPulseOximeter	A clip oximeter is a clip in which a light source and a photosensor are placed and by means of oxygen saturation in the blood can be measured.

	DisposibleAdhesiveOximete	An adhesive oximeter consists of a patch in which a light source and a photo sensor positioned. This sensor is used only once.

«state»	InstrumentTemperature	
Definitie	The temperature of the instrument can influence the measurement.	
Datatype		
Opties	Low	Temperature of the instrument is lower than the room temperature
	RoomTemperature	Temperature of the instrument as the room temperature
	Hot	Temperature of the instrument is higher than room temperature

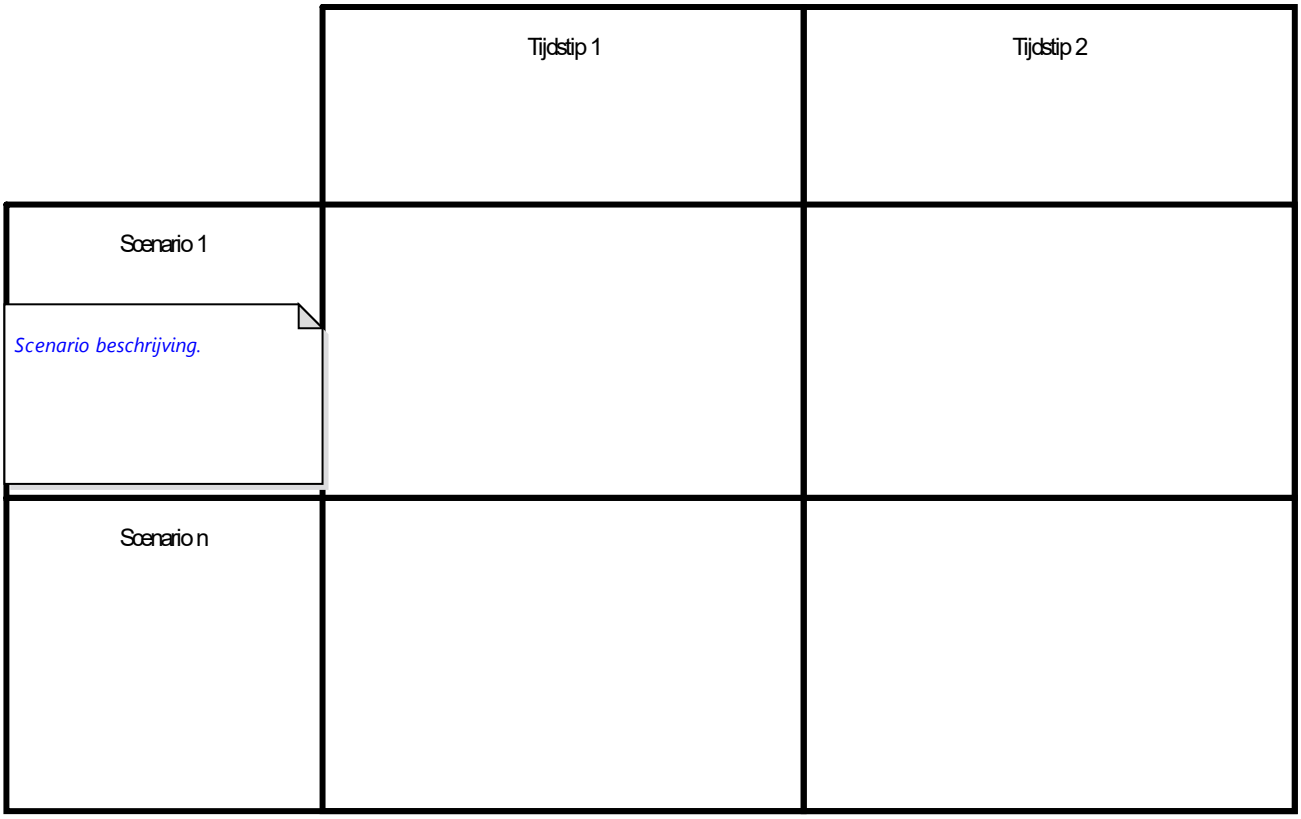
«state»	MeasurementPlacement	
Definitie	The oximeter is usually placed on a fingertip. In the event of poor circulation or other injury, the meter can also be placed on the earlobe, nostril, lip or big toe. When placing on the finger or toe, any nail polish should any be removed.	
Datatype		
DCM::DefinitionCode	LOINC:20081-6 Pulse oximetry site	
Opties	Finger	The oximeter is placed on the finger of the patient SCT:7569003: finger structure (Body structure)
	Earlobe	The oximeter is placed on an earlobe of the patient SCT:48800003: ear lobule structure (Body Structure)
	Nostril	The oximeter is placed in a nostril of the patient SCT:1797002: structure of anterior naris (Body Structure)
	Lip	The oximeter is placed on the lip of the patient SCT:181221003: entire lip (Body Structure)
	BigToe	The oximeter is placed on a big toe of the patient

	SCT:78883009: hallux structure (Body Structure)

«qualifier»	Method	
Definitie	The way oxygen is measured.	
Datatype		
Opties	Continues	The measurement of oxygen saturation takes place continuously. SCT:427064004: continuous pulse oximetry
	OneOff	Oxygen saturation is determined once.
	Overnight	Oxygen saturation is measured during the night. SCT:252568001: overnight pulse oximetry

«state»	PatientStatus	
Definitie	Oxygen saturation at rest may differ from the oxygen saturation during and after exercise. If the patient moves, the oximeter may shift so that the measurement is less reliable.	
Datatype		
Opties	AtRest	Patient lies quietly in bed or sleeping
	DuringExercise	Oxygen saturation is measured during exercise of the patient .
	AfterExercise	Oxygen saturation is measured after exercise of the patient.
	PatientIsRestless	Patient is not consciously excercising, but is restless

1.7 Example Instances



1.8 Instructions

The measurement of oxygen saturation is indicated for: mechanical ventilatory support, weaning from the ventilator, respiratory insufficiency, pre- and postoperative monitoring, and physiological research. Before use, clean the probe with a 70% alcohol solution. Change measurement location at least every 4 hours to to prevent pressure sores. The usual position is the finger, however in the event of cold or poorly perfused extremities, an earlobe, nostril or lip may be used. Any nail polish should be removed before measuring. In restless patients an adhesive sensor can be used. A disposable sensor should be replaced every 24 hours. (NVICV - VICP, 2008). The type of sensor depends on the location.
To set the alarm values, the waveform (plethysmogram) is monitored. The values found in the patient file should be listed in the patient record.

Use the "wrap" oximeters (adhesive sensor) on the fingers, big toe or nose. The windows for the light source and photo detector are placed directly opposite each other on each side of the arteriolar bed to ensure accuracy of SpO_2 measurements. Choosing the correct size of the sensor can help to influence the effect of ambient light reduction. "Clip" style sensors can be applied to fingers (except the thumb) and the earlobe. Here too, the windows for the light source and photo detector are placed directly opposite each other on each side of the arteriolar bed, thus reducing the influence of ambient light interference (Schutz, 2001).

1.9 Interpretation

Normal oxygen saturation values are between 95% and 100% (TPVO, 2004). An SpO_2 value below 90% indicates that there is hypoxia or a decrease in oxygen saturation, where the body is not getting enough oxygen (Wikipedia, 2008). Visible cyanosis occurs only at an oxygen saturation below 67% (Honeywell, 2008).
The normal oxygen saturation in healthy newborns breathing room air is 93% and varies with postnatal age (Castillo, 2008). Twenty years ago, Reynolds and Yu recommended guidelines (Reynolds, 1988) for the use of SpO_2 values. This opinion suggested that the lower alarm limit for children with acute respiratory problems was 85%, and the higher alarm limit was 90%. However, safety and potential benefits of these recommendations were not evaluated. Several studies suggest the avoidance of SpO_2 values between 95% and 100% in preterm infants who receive supplemental oxygen. In 2003 Castillo et al (2008) reported that the use of adequate SpO_2 measurement technology, with the intention of avoiding saturation values between 95% and 100% and avoiding large fluctuations in SpO_2 levels, are associated with lower morbidity rates in newborns of <1500 grams (Castillo, 2008).

1.10 Care Process

Measuring the oxygen saturation is part of the monitoring of vital functions. As with other observations, the impact of the measurement is on treatment.

1.11 Example of the Instrument

1.12 Constraints

1.13 Issues

1.14 References

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1.15 Functional Model

1.16 Traceability to other Standards

Is this a Vital Sign?
It is not mentioned in CCR/CCD.

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