

6.8.34 TransformerWinding

A winding is associated with each defined terminal of a transformer (or phase shifter).

Native Attributes

b	Susceptance	Magnetizing branch susceptance (B mag).
insulationKV	Voltage	Basic insulation level voltage rating
connectionType	WindingConnection	The type of connection of the winding (e.g. Delta, Wye, zigzag)
emergencyMVA	ApparentPower	The MVA that the winding can carry under emergency conditions.
g	Conductance	Magnetizing branch conductance (G mag).
grounded	Boolean	Set if the winding is grounded.
r	Resistance	Positive sequence series resistance of the winding.
r0	Resistance	Zero sequence series resistance of the winding.
ratedKV	Voltage	The rated voltage (phase-to-phase) of the winding, usually the same as the neutral voltage.
ratedMVA	ApparentPower	The normal MVA rating for the winding
rground	Resistance	Ground resistance path through connected grounding transformer.
shortTermMVA	ApparentPower	MVA that the winding can carry for a short period of time.
windingType	WindingType	The type of winding, i.e., Primary, Secondary, Tertiary, Quaternary.
x	Reactance	Positive sequence series reactance of the winding.
x0	Reactance	Zero sequence series reactance of the winding.
xground	Reactance	Ground reactance path through connected grounding transformer.

Inherited Attributes

phases	PhaseCode	ConductingEquipment
mRID	String	IdentifiedObject
name	String	IdentifiedObject
localName	String	IdentifiedObject
pathName	String	IdentifiedObject
aliasName	String	IdentifiedObject
description	String	IdentifiedObject

Native Roles

1..n	MemberOf_PowerTransformer	1	<u>PowerTransformer</u>	A transformer has windings
1	TapChangers	0..n	<u>TapChanger</u>	A transformer winding may have tap changers, separately for voltage and phase angle
1	From_WindingTests	0..n	<u>WindingTest</u>	The winding from which the test was conducted
0..n	To_WindingTest	0..1	<u>WindingTest</u>	The winding to which the test was conducted

Roles Inherited From ConductingEquipment

1	Terminals	0..n	<u>Terminal</u>	ConductingEquipment
0..n	BaseVoltage	0..1	<u>BaseVoltage</u>	ConductingEquipment

1	<i>ClearanceTags</i>	0..n	<u>ClearanceTag</u>	ConductingEquipment
0..n	<i>ProtectionEquipments</i>	0..n	<u>ProtectionEquipm ent</u>	ConductingEquipment

Roles Inherited From Equipment

0..n	<i>MemberOf_Equipment Container</i>	0..1	<u>EquipmentContai ner</u>	Equipment
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Roles Inherited From PowerSystemResource

0..n	<i>OperatedBy_Compani es</i>	0..n	<u>Company</u>	PowerSystemResource
0..n	<i>PSRType</i>	0..1	<u>PSRType</u>	PowerSystemResource
1	<i>Contains_Measureme nts</i>	0..n	<u>Measurement</u>	PowerSystemResource
1	<i>OutageSchedule</i>	0..1	<u>OutageSchedule</u>	PowerSystemResource

Roles Inherited From IdentifiedObject

1..n	<i>ModelingAuthoritySet</i>	0..1	<u>ModelingAuthority Set</u>	IdentifiedObject
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6.8.23 PowerTransformer

An electrical device consisting of two or more coupled windings, with or without a magnetic core, for introducing mutual coupling between electric circuits. Transformers can be used to control voltage and phase shift (MW flow). The typeName attribute indicates type of transformer.

Native Attributes

bmagSat	PerCent	Core shunt magnetizing susceptance in the saturation region, in per cent.
magBaseKV	Voltage	The reference voltage at which the magnetizing saturation measurements were made
magSatFlux	PerCent	Core magnetizing saturation curve knee flux level.
Phases	PhaseCode	Describes the phases carried by a power transformer. Possible values { ABCN , ABC, ABN, ACN, BCN, AB, AC, BC, AN, BN, CN, A, B, C, N }.
transfCoolingType	TransformerCoolingType	Type of transformer cooling -
transformerType	TransformerType	

Inherited Attributes

mRID	String	IdentifiedObject
Name	String	IdentifiedObject
localName	String	IdentifiedObject
pathName	String	IdentifiedObject
aliasName	String	IdentifiedObject
description	String	IdentifiedObject

Native Roles

1	<i>HeatExchanger</i>	0..1	<u>HeatExchanger</u>	A transformer may have a heat exchanger
1	<i>Contains_Transformer Windings</i>	1..n	<u>TransformerWinding</u>	A transformer has windings

Roles Inherited From Equipment

0..n	<i>MemberOf_Equipment Container</i>	0..1	<u>EquipmentContainer</u>	Equipment
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Roles Inherited From PowerSystemResource

0..n	<i>OperatedBy_Companies</i>	0..n	<u>Company</u>	PowerSystemResource
0..n	<i>PSRType</i>	0..1	<u>PSRType</u>	PowerSystemResource
1	<i>Contains_Measurements</i>	0..n	<u>Measurement</u>	PowerSystemResource
1	<i>OutageSchedule</i>	0..1	<u>OutageSchedule</u>	PowerSystemResource

Roles Inherited From IdentifiedObject

1..n	<i>ModelingAuthoritySet</i>	0..1	<u>ModelingAuthoritySet</u>	IdentifiedObject
------	-----------------------------	------	-----------------------------	------------------

6.8.24 ProtectedSwitch

A ProtectedSwitch is a switching device that can be operated by ProtectionEquipment.

Inherited Attributes

normalOpen	Boolean	Switch
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4.4.4 Transformer Model

Figure 10 shows a portion of the Wires class diagram which models a PowerTransformer device.

As shown, a PowerTransformer is a specialized class of Equipment, which is a specialized class of a PowerSystemResource, as is ConductingEquipment and TapChanger. This is shown by the use of the generalization-type of relationship, which uses an arrow to point to the general class, and permits the PowerTransformer to inherit attributes from both Equipment and PowerSystemResource.

A PowerTransformer also has a TransformerWinding, which is modeled with an aggregation-type of relationship using a diamond symbol to point from the part class to the whole class. As shown, a PowerTransformer may have (or contain) one or more TransformerWindings, but a TransformerWinding may belong to (or be a member of) only one PowerTransformer.

The TransformerWinding has other relationships as well:

- A generalization relationship with ConductingEquipment
- An association relationship with the WindingTest class, such that a TransformerWinding object may be TestedFrom from 0, 1, or more WindingTest objects.
- An aggregation relationship with the TapChanger class, such that a TransformerWinding object may have 0, 1, or more TapChanger objects associated with it.

Clause 6 contains a complete description of each class in Figure 10 along with the definition of all the attributes and relationships supported in each class.

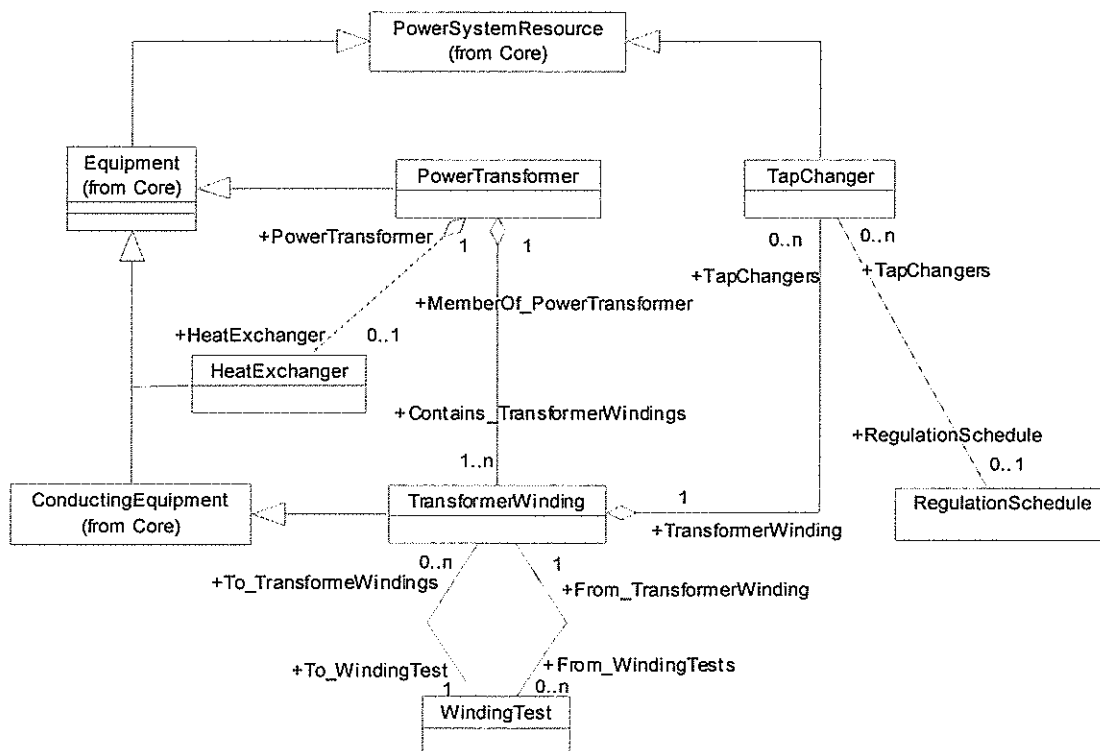


Figure 10 – Transformer Model

CIM XML INCREMENTAL File

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- <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:cim="http://iec.ch/TC57/2003/CIM-schema-cim10#"
  xmlns:dm="http://iec.ch/2002/schema/CIM_difference_model#"
  xml:Base="Siemens">
- <dm:DifferenceModel>
  <!-- Base file: C:\SIEMENS\PowerCC\Temp\rdfChangeLog_old.xml -->
  <!-- Total Nodes: 5 -->
  <!-- New Files C:\SIEMENS\PowerCC\Temp\rdfChangeLog_new.xml -->
  <!-- Total Added Nodes 0 -->
  <!-- Total Deleted Nodes 0 -->
  <!-- Total Modified Nodes 2 -->
  <dm:preconditions parseType="Statements" xml:Base="Siemens" />
- <dm:forwardDifferences parseType="Statements" xml:Base="Siemens">
  <!-- The following 2 object(s) have been changed -->
  - <rdf:Description rdf:about="#_DFBA01C1577D43A387004604316BABC3">
    <cim:TransformerWinding.r>0.03</cim:TransformerWinding.r>
    </rdf:Description>
  - <rdf:Description rdf:about="#_482BDF4273E44BE68AC761C57AA53063">
    <cim:Compensator.mVArPerSection>-
      4</cim:Compensator.mVArPerSection>
    </rdf:Description>
  </dm:forwardDifferences>
- <dm:reverseDifferences parseType="Statements" xml:Base="Siemens">
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    </rdf:Description>
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</dm:DifferenceModel>
</rdf:RDF>

```

MODIFIES ATTRIBUTE VALUES ON
A TRANSFORMER WINDING

CIM XML INCREMENTAL File

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  xmlns:dm="http://iec.ch/2002/schema/CIM_difference_model#">
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  - <dm:reverseDifferences rdf:parseType="Statements">
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      <cim:TapChanger.stepVoltageIncrement>2.15395</cim:TapChanger.stepVoltageIncre
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```

*This file modifies Attribute values on
A Tap Changer*

```

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  </cim:Substation>
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- <cim:Breaker rdf:ID="_6B101BEFF4074A408911F2D1C77288BB">
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  <cim:Switch.normalOpen>false</cim:Switch.normalOpen>
  <cim:Equipment.MemberOf_EquipmentContainer
    rdf:resource="#_C7E96E47FA342DA85FBA4DCEA9ED622" />
</cim:Breaker>
- <cim:Terminal rdf:ID="_CE39BEA8FC58489D93ACB4F5AE9AD867">
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    rdf:resource="#_BCEE638FC08646B2AD6CEDBFC770F082" />
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- <cim:Terminal rdf:ID="_B474A4749E654B00A20BD7337FC7A362">
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  <cim:Terminal.ConductingEquipment
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    rdf:resource="#_4542F74A42C044F5BC79DA4FEFCD111A" />
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- <cim:Bay rdf:ID="_DD166B093985482FB071D7FA89CE68F8">
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- <cim:Breaker rdf:ID="_2923B3F8FFA94D26B0046C6F1FEAFF07">
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  <cim:Switch.normalOpen>false</cim:Switch.normalOpen>
  <cim:Equipment.MemberOf_EquipmentContainer
    rdf:resource="#_DD166B093985482FB071D7FA89CE68F8" />
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- <cim:Terminal rdf:ID="_B133C3EF55E24FCB95364FC4B0C83C69">
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- <cim:Terminal rdf:ID="_2CE3C4AB42F849569274C9B64D6CFDA6">
  <cim:Naming.name>T1</cim:Naming.name>
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    rdf:resource="#_DF0B9B703DFC44FE8776EC196B0FE532" />
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- <cim:BusbarSection rdf:ID="_BA52641C37E64145A44259476EDCEB60">
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  <cim:Equipment.MemberOf_EquipmentContainer
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- <cim:Terminal rdf:ID="_3929E7C2BA9F4FD885069FCC5C622CF5">
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  <cim:Terminal.ConductingEquipment
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- <cim:Terminal rdf:ID="_EEBF27EF2A3E43CBA6C39F559E70699D">
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  <cim:Terminal.ConductingEquipment
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  <cim:Terminal.ConnectivityNode
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  <cim:Equipment.MemberOf_EquipmentContainer
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- <cim:Terminal rdf:ID="_9FFA2BE9BB074434A94496722FEE551B">

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- <cim:EnergyConsumer rdf:ID="_6C1DBEF736504E9F87ABA78F2EDD895F">
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  <cim:EnergyConsumer.conformingLoadFlag>true</cim:EnergyConsumer.conformingLoadF
  <cim:EnergyConsumer.pfixed>207.9</cim:EnergyConsumer.pfixed>
  <cim:EnergyConsumer.qfixed>58.8</cim:EnergyConsumer.qfixed>
  <cim:EnergyConsumer.LoadArea
    rdf:resource="#_D0F778F5270A4DDC91E2BFA2CC2EAF5C" />
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- <cim:Terminal rdf:ID="_6EAA4F4A0CCE4279944967A8698C921A">
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  <cim:Terminal.ConductingEquipment
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- <cim:BusbarSection rdf:ID="_6C970D83B0CA46758544C64112498A71">
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- <cim:Terminal rdf:ID="_C6B2CFD3C89144358D900C2DE25DF67F">
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  <cim:Terminal.ConnectivityNode
    rdf:resource="#_4542F74A42C044F5BC79DA4FEFCD111A" />
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- <cim:ConnectivityNode rdf:ID="_1CF9240B3CDC46E5827ACE6929CBCA2C">
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- <cim:BusbarSection rdf:ID="_3E595276DF9D41678CD8F582AA1C4256">
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- <cim:Terminal rdf:ID="_9789AB05B7F945CC8C09C9279DAB2F38">
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  <cim:Terminal.ConductingEquipment
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- <cim:ConnectivityNode rdf:ID="_AB701D4E2A464BF090DBF81683DA2014">
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- <cim:Terminal rdf:ID="_B06BC21EEB434F21ACD41FE827F88F42">

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      rdf:resource="#_8CE8BE3CF9E3473AB9DD7F2575B7D61A" />
  </cim:Terminal>
- <cim:PowerTransformer rdf:ID="_BE2986AEC0774376A1E89360A72617D3">
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  <cim:PowerTransformer.transformerType
    rdf:resource="http://iec.ch/TC57/2001/CIM-schema-
    cim10#TransformerType.voltageControl" />
  <cim:Equipment.MemberOf_EquipmentContainer
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  </cim:PowerTransformer>
- <cim:TransformerWinding rdf:ID="_6359F34F962048E5A3871B12EA42DC89">
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  <cim:TransformerWinding.b>0</cim:TransformerWinding.b>
  <cim:TransformerWinding.r>0</cim:TransformerWinding.r>
  <cim:TransformerWinding.ratedMVA>825</cim:TransformerWinding.ratedMVA>
  <cim:TransformerWinding.windingType
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    cim10#WindingType.secondary" />
  <cim:TransformerWinding.x>0</cim:TransformerWinding.x>
  <cim:TransformerWinding.MemberOf_PowerTransformer
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- <cim:Terminal rdf:ID="_DF0B9B703DFC44FE8776EC196B0FE532">
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  <cim:Terminal.ConductingEquipment
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    rdf:resource="#_729BD33E710B4C6AA00B1352542AA423" />
  </cim:Terminal>
- <cim:TapChanger rdf:ID="_EB21BD6CB7F74375971D95D9B2BC03DB">
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  <cim:TapChanger.highStep>8</cim:TapChanger.highStep>
  <cim:TapChanger.lowStep>-8</cim:TapChanger.lowStep>
  <cim:TapChanger.neutralKV>230</cim:TapChanger.neutralKV>
  <cim:TapChanger.neutralStep>0</cim:TapChanger.neutralStep>
  <cim:TapChanger.normalStep>0</cim:TapChanger.normalStep>
  <cim:TapChanger.stepPhaseShiftIncrement>0</cim:TapChanger.stepPhaseShiftIncrement>
  <cim:TapChanger.stepVoltageIncrement>0.625</cim:TapChanger.stepVoltageIncrement>
  <cim:TapChanger.TransformerWinding
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- <cim:TransformerWinding rdf:ID="_115F9B5A4D84DF08D92C938E3D31F2A">
  <cim:Naming.name>High Winding</cim:Naming.name>
  <cim:TransformerWinding.b>0</cim:TransformerWinding.b>
  <cim:TransformerWinding.r>2.25</cim:TransformerWinding.r>
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  cim10#WindingType.primary" />
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  <cim:TransformerWinding.MemberOf_PowerTransformer
    rdf:resource="#_BE2986AEC0774376A1E89360A72617D3" />
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- <cim:Terminal rdf:ID="_9CA3F4DDB5754F8DBEA70853CF2FC02A">
  <cim:Naming.name>T1</cim:Naming.name>
  <cim:Terminal.ConductingEquipment
    rdf:resource="#_115F9B5A4D84DF08D92C938E3D31F2A" />
  <cim:Terminal.ConnectivityNode
    rdf:resource="#_F4CF1A4C2B40420E9BC7DF4B7965DDA3" />
</cim:Terminal>
- <cim:TapChanger rdf:ID="_3A539BB2FA8948DFBCBA5E4D364F355F">
  <cim:Naming.name>High Tap</cim:Naming.name>
  <cim:TapChanger.highStep>2</cim:TapChanger.highStep>
  <cim:TapChanger.lowStep>-2</cim:TapChanger.lowStep>
  <cim:TapChanger.neutralKV>500</cim:TapChanger.neutralKV>
  <cim:TapChanger.neutralStep>0</cim:TapChanger.neutralStep>
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  <cim:TapChanger.stepPhaseShiftIncrement>0</cim:TapChanger.stepPhaseShiftIncrement>

  <cim:TapChanger.stepVoltageIncrement>2.5</cim:TapChanger.stepVoltageIncrement>
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