Data Format

The properties for the formation are contained in a *.use* file, which must be named with the prefix ***TGR_.*** Each *.use* file may contain multiple material property sets.

Properties for the Matrix

The format of the file is shown overleaf. The data is in the standard format for an Elfen data file, with identifiers for each set of properties and for the subsets within the property set for each material. In the extract overleaf, note that annotations in purple on the right hand side are for information only and do not appear in the *.use* file.

Each matrix material has the following types of property subset:

- Geomechanical – elasticity (Section TGT.2.2.1) and optional plasticity (Section TGT.2.2.2),
- Matrix gas flow properties – (Section TGT.2.5.5.1); these are only for gas production stages (see Section TGT.2.5),
- Effective Media Properties – (Section TGT2.2.4); for continuum representation of DFNs.

Geomechanical Properties

These comprise:

- Units – Length, Pressure
- Elastic Properties – Isotropic flag (currently always 0), Elastic Model, Elastic properties
- Hardening Properties – Effective Plastic Strain vs Cohesion (for Mohr-Coulomb Model)

Matrix Gas Flow Properties

These comprise:

- Units – Length, Pressure
- Gas Properties – Isotropic flag (currently always 0), Gas Model, Gas model properties

Effective Media Properties

These comprise:

- Geometric property data,
- Property data,
- Local co-ordinate system,
- Permeability-related properties (optional).

```
material_data { 1                                                    Start of property set
  material_name {
   "Sandstone"
  }
# Elasticity model data
# ######################################

  Elastic_material_flags { NFGELA { 4 }
    0 1 0 0
  }
# Elastic properties from Ref [1]
 Elastic_properties { NMPRP { 15 }
 31.0E+09 0 0 0.25 0 0 0 0 0 0 0 0 2.60E+03 0 0
 }

# Plasticity - Mohr Coulomb Model with Rankine failure
# ####################################################
 Plastic_material_flags { NFGPLS { 2 }
 0 19
 }
 Plastic_properties { NPRPLS { 3 }
 13.0E+06  38.0  0
 }
 Hardening_material_flags { 4
 0 2 0 0
 }
 Hardening_properties { 2  4
    0.00    0.6
    13.0E+06   13.0E+06
    38.0  38.0
     0.0    0.0
 }

# Tensile failure model data
# ##########################
  Failure_material_flags { 3
    0  1   4
  }
# Ref [1]
  Failure_properties { 4
    1.0E+06 165     0.0   0.0
  }

# Matrix consolidation data
# ######################################
   Grain_density {
     2.71E+03
  }
  Solid_bulk_modulus {
     2.06E+10
  }
  Biot_constant {
     0.75
  }

# Matrix permeability data
# ######################################
  Permeability_properties_flags { 2
  0 1
  }
# Permeability value from Ref [2]
  Permeability_properties { 1 1
  1E-16
  }

# Matrix gas flow data
# ######################################
# From Ref [3]
   Klinkenberg_factors {  3
     7.6e5   0.0    0.0             # [Pa]
   }
}                                                    End of material property set properties
```

Properties for Matrix

```
Material_data { 1                                                    Start of property set
  Material_name {
  "Shale"
  }
# Matrix consolidation data
# ########################################

   Grain_density {
     2.70E+03
  }
  Solid_bulk_modulus {
     1.53E+10
  }
  Biot_constant {
     1.0
  }
# Matrix gas flow data
# ########################################
# From Ref [3]
    Permeability_properties { 1 1
      4.90E-21
    }

     Klinkenberg_factors {  3
       7.6e5   0.0    0.0             # [Pa]
   }
# Gas consolidation data
# ############################

  Gas_molar_weight { 1
     16.043E-3
  }
# Gas flow data
# ############################

# From Ref [1], Fig 2.19 (Temperature 75 degrees F)
  Gas_viscosity { NPRP { 1 } NSET { 1 }
     1.00e-5
  }
  Viscosity_pressure_function  {   NSET { 2 }    2
     0   66.2E6
     1   4
  }
  Gas_density_update_flag { 2
     0   1
  }
# Gas adsorption data
# ############################

  Gas_adsorption_properties {   NGFADS { 3 } NSET { 1 }
     0.01  7.5e6  22.414e-3
  }
  Gas_permeability_property_flags { NFGPER { 2 }
     0 1
  }
}                                                                    End of property set
```

Properties for Matrix for Gas Production Stage

```
Geometric_property_data { IGROUP { 1 }
 Group_plane_weakness_data { NPWPLN { 4 } NPWDAT { 3 }
   5  6  7  8                                  Local co-ordinate set numbers for the planes
   1  1  1  1                                  Property set used by each plane
   0  0  0  0                                  Always 0
 }
 Plane_weakness_order_flag {
  1                                            Governs how failure involving multiple planes is treated
 }
}
```

```
Local_coordinate_systems { 0
 System_numbers { NCSYS { 3 }
     1  2  3                                   Identifying numbers for systems
 }
 System_types { NCSYS { 3 }
     1  1  1                                   1 = Cartesian co-ordinate system
 }
 Local_system_data { NDIME { 2 } NINODE { 2 } NCSYS { 3 }
    1        1         0         0             Co-ords for system origin and point defining local X for system 1
    0.2588  0.9659    0         0             Co-ords for system origin and point defining local X for system 2
    0        0        -0.8190  0.5736         Co-ords for system origin and point defining local X for system 3
 }
}
```

```
Plane_weakness_property_data { IPWPNB { 1 }
 Plane_weakness_property_flag {               Constitutive law governing the PoW
   1                                          1 = Mohr-Coulomb with Rankine Tensile Failure
 }
 Plane_weakness_properties { NPWPRP { 6 }     Properties associated with the chosen law
    500e6     60.0      1e6     1000    0.0   0.5
 }
 Plane_weakness_damage_flags { 2
    1    0                                    Type of damage allowed
 }
}
```

```
Permeability_strain_function { IGROUP
Permeability_POW_NM_strain_func { 3 2
   -0.2     0        0.2                     PoW normal strain values for chosen model
  1e-13   1e-11 1e-10                       permeability values
 }
Permeability_POW_SH_strain_func { 3 2
   -0.2     0        0.2                     PoW shear strain values for chosen model
  1e-13   1e-11 1e-10                       permeability values
 }
}
}
```

```
Material_data {  1
 :
Strain_dependent_perm_model {
    141                                      Model number for strain-dependent permeability (explicit structural data file)
 }
 :
}
```

```
Material_data {  1
 :
Permeability_properties_flags { 2
    0  141                                   Model number for strain-dependent permeability (implicit flow data file)
 }
 :
}
```

Additional Properties for Matrix with Effective Media Models

Tags for Matrix Material Properties

Name	Dimensions			Requirement
	I	J	K	
Elastic_material_flags	NFGELA			Compulsory
Elastic_properties	NMPRP			Compulsory
Plastic_material_flags	NFGPLS			Optional
Plastic_properties	NPRLPS			Optional
Hardening_material_flags	N	N		Optional
Hardening_properties	2	N		Optional
Failure_material_flags	3			Optional
Failure_properties	4			Optional
Grain_density	-			Compulsory
Solid_bulk_modulus	-			Compulsory
Biot_constant	-			Compulsory
Liquid_density	-			Compulsory
Liquid_bulk_modulus	-			Compulsory
Gas_molar_weight	N			Compulsory
Group_plane_weakness_data *	NPWPLN	NPWDAT		Optional
Plane_weakness_property_data *	-			Optional
Plane_weakness_property_flag *	-			Optional
Plane_weakness_properties *	NPWPRP			Optional
Plane_weakness_damage_flags *	2			Optional
Plane_weakness_model_type *	-			Optional
Nonlinear_compliance_flag *	-			Optional
Nonlinear_compliance_properties *	NCMPOI	NCMPRP		Optional
System_numbers *	NCSYS			Optional
System_types *	NCSYS			Optional
Local_system_data *	NDIMN	NCSYS		Optional
Permeability_strain_function *				Optional
Permeability_POW_NM_strain_func *				Optional
Permeability_POW_SH_strain_func *				Optional
Permeability_properties_flags	NFGPER			Optional
Strain_dependent_perm_model				Optional

Table TGT.3 List of Tags for Matrix Properties

> ***Note :*** These tags are all found under *Material_data*, except for those marked with an asterisk (*), which are specified in the *.use* file but placed under separate sections in the data file.

Name **Elastic_material_flags**

Type Integer vector

Dimensions NFGELA Number of material flags (normally 4)

Description Material flags for elastic properties.

Location 1 Temperature function flag
- 0 not temperature dependent
- 1 temperature dependent

Location 2 Elastic material model type
- 1 Isotropic
- 2 Orthotropic

Name **Elastic_properties**

Type Real vector

Dimensions NMPRP Number of material properties (normally 15 or 18)

Description Elastic material properties.

Location 1	E_1	Young's modulus in the 1-direction
Location 2	E_2	Young's modulus in the 2-direction
Location 3	E_3	Young's modulus in the 3-direction
Location 4	ν_{12}	Poisson's ratio in the 12-direction
Location 5	ν_{23}	Poisson's ratio in the 23-direction
Location 6	ν_{31}	Poisson's ratio in the 31-direction
Location 7	G_{12}	Shear modulus in the 12-direction
Location 8	G_{23}	Shear modulus in the 23-direction
Location 9	G_{31}	Shear modulus in the 31-direction
Location 10	α_1	Coefficient of expansion in the 1-direction
Location 11	α_2	Coefficient of expansion in the 2-direction
Location 12	α_3	Coefficient of expansion in the 3-direction
Location 13	ρ	Density
Location 14	α	Coefficient Rayleigh damping
Location 15	β	Coefficient Rayleigh damping

Notes

1. A value of 0.5 for Poisson's ratio is not permissible. For incompressible materials, a value close to 0.5 should be specified, e.g. 0.4999.

2. For isotropic materials, values are only specified for the first direction. The remaining directions are set as 0.

Name **Plastic_material_flags**

Type Integer vector

Dimensions NFGPLS Number of plastic material flags (normally 2)

Description Material flags for plastic properties.

Location 1 Temperature function number
(1 if temperature dependent, 0 if not)

Location 2 Plastic material model type
- 3 Standard Mohr Coulomb with nonlinear isotropic hardening

Name **Plastic_properties**

Type Real vector

Dimensions NPRPLS Number of plastic material properties (model-dependent)

Description Plastic material properties (model-dependent)

For Mohr-Coulomb:

Location 1 Initial cohesion c

Location 2 Initial friction angle ϕ

Location 3 Initial dilatancy angle ψ

Location 4 Tension cutoff

Name **Hardening_material_flags**

Type Integer vector

Dimensions NFGHRD Number of hardening material flags (normally 1 or 2)

Description Material flags for hardening properties.

Location 1 Temperature or strain rate function number

- 0 Temperature and strain rate independent
- 1 Temperature dependent only
- 2 Strain rate dependent only
- 3 Temperature and strain rate dependent

Location 2 Hardening model type

- 1 Standard hardening (default)
- 2 Regularized softening based on nonlinear resistance curve theory

---

Name **Hardening_properties**

Type Real matrix

Dimensions NHARDS Number of points on hardening curve

NPRHRD Number of hardening properties

Description Hardening material properties.

For Mohr-Coulomb

Row 1 Effective Plastic strain

Row 2 Initial cohesion c

Row 3 Initial friction angle ϕ

Row 4 Initial dilatancy angle ψ

Name **Failure_material_flags**

Type Integer vector

Dimensions NFGFAL Number of failure material flags (normally 3)

Description Failure material flags.

Location 1 Temperature function number
(1 if temperature dependent, 0 if not)

Location 2 Failure criteria (model dependent)
If Fracture (failure model = 1)
n Number of times to fracture before becoming elastic

Location 3 4

Name **Failure_properties**

Type Real vector

Dimensions NPRFAL Number of failure material properties

Description Failure material properties
For Fracture, NPRFAL = 3:

Location 1 Tensile strength F_t

Location 2 Specific fracture energy G_f

Location 3 Residual tensile strength after failure

Name **Grain_density**

Type Real variable

Dimensions -

Description Grain density of porous medium.

Name **Solid_bulk_modulus**

Type Real variable

Dimensions -

Description Solid bulk density of porous medium.

Name **Biot_constant**

Type Real variable

Dimensions -

Description Biot parameter.

Name **Liquid_density**

Type Real variable

Dimensions -

Description Density of liquid.

Name **Liquid_bulk_modulus**

Type Real variable

Dimensions -

Description Bulk modulus of liquid.

Name **Gas_molar_weight**

Type Real vector

Dimensions 1

Description Gas molar weight.

Name **Group_plane_weakness_data**

Type Integer matrix

Dimensions NPWPLN Number of weakness planes

NPWDAT 2 or 3

Description Data defining the planes of weakness property data and local coordinate system for each plane.

Row 1 Local coordinate system set number for each plane

Row 2 Planes of weakness property set number

Row 3 0

Name **Plane_weakness_property_data**

Type Integer variable

Dimensions -

Description Data defining the planes of weakness property data and local coordinate system for each plane.

Name **Plane_weakness_property_flag**

Type Integer variable

Dimensions -

Description Constitutive law for the planes of weakness.

1 Mohr Coulomb law with Tensile Failure (Rankine Softening)

Name **Plane_weakness_properties**

Type Real vector

Dimensions NPWPRP Number of properties defining weakness planes

Description Properties defining the planes of weakness.

Model 1 Mohr Coulomb-Rankine

Location 1 Initial joint cohesion value (shear failure)

Location 2 Initial joint friction angle (shear failure)

Location 3 Joint tensile strength (tensile failure)

Location 4 Joint specific fracture energy (tensile failure)

Location 5 Initial joint gap (normal direction)

Location 6 Initial joint spacing (normal direction)

Name **Plane_weakness_model_type**

Type Integer variable

Dimensions -

Description Defines the model type of the planes of weakness.

3 Effective media

Name **Plane_weakness_damage_flags**

Type Integer vector

Dimensions 2

Description Damage flags for planes of weakness.

Location 1 Fracture flag (always 1)

Location 2 Tensile damage flag (always 0)

Name **Nonlinear_compliance_flag**

Type Integer variable

Dimensions -

Description Flag to include nonlinear joint compliance.

0 Use linear compliance (stress=normal penalty value * penetration) (Default)

1 Specification of joint normal stress as a function of normal penetration or strain

---

Name **Nonlinear_compliance_properties**

Type Real matrix

Dimensions NCMPOI Number of points on nonlinear compliance curve

NCMPRP Number of nonlinear joint compliance properties (=2)

Description Nonlinear joint compliance properties.

Row 1 Joint normal penetration or strain

Row 2 Joint normal stress (*Flag=1*) or joint normal stiffness (*Flag=2*)

Name **System_numbers**

Type Integer vector

Dimensions NCSYS Number of coordinate systems

Description Local coordinate system numbers.

Name	**System_types**
Type	Integer vector
Dimensions	NCSYS Number of coordinate systems
Description	Local coordinate system type number. 1 Cartesian 2 Cylindrical 3 Spherical

Name	**Local_system_data**
Type	Real matrix
Dimensions	NDIMN Number of dimensions NDIMN Number of dimensions NCSYS Number of coordinate systems
Description	Coordinates of points defining local coordinate systems.

Note

For Cartesian systems in 2D, the first point specifies the origin and the second is a point along the local X axis. For 3D, 3 points are required – the origin, a point on the local X axis and a point on the local XY plane (the Z direction is derived using the RH rule).

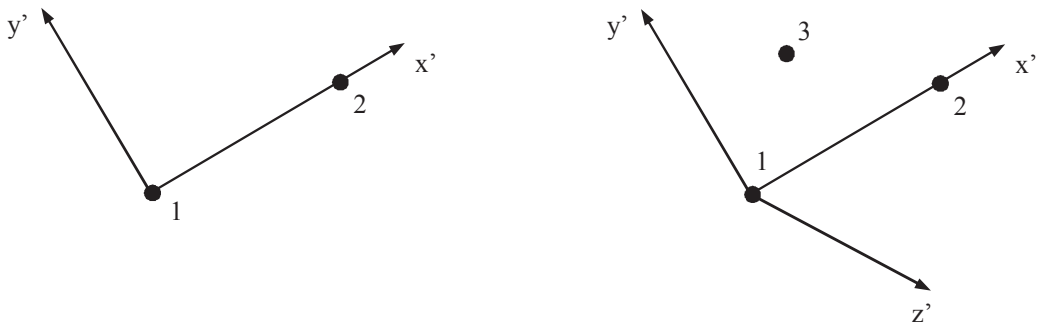

Figure TGT.4 Local Co-ordinate Systems (Cartesian)

Name	**Permeability_strain_function**
Type	-
Dimensions	-
Description	Defines permeability strain data

Name	**Permeability_POW_NM_strain_func**
Type	Real matrix
Dimensions	N Number of strain values 2
Description	Piecewise linear curve specifying the relationship between permeability and normal strain. Row 1 PoW normal strain Row 2 Permeability

Name	**Permeability_POW_SH_strain_func**
Type	Real matrix
Dimensions	N Number of strain values 2
Description	Piecewise linear curve specifying the relationship between permeability and shear strain. Row 1 PoW shear strain Row 2 Permeability

Name	**Strain_dependent_perm_model**
Type	Integer value
Dimensions	-
Description	Model number for strain-dependent permeability properties. 141 Permeability dependent on PoW normal strain 142 Permeability dependent on PoW shear strain 143 Permeability dependent on PoW normal and shear strain 141 Permeability dependent on PoW normal strain 142 Permeability dependent on PoW shear strain 143 Permeability dependent on PoW normal and shear strain

Notes

1. This tag is only used in the explicit structural data file.

2. For isotropic models, the permeability will be modified in all directions. For anisotropic models, the permeability will only be modified along the plane defining the PoW, and then transferred into the global coordinate system.

Name	**Permeability_properties_flags**	
Type	Integer vector	
Dimensions	NFGPER	Number of permeability flags (=2)
Description	Flags for permeability properties.	
	Location 1	Temperature function number (1 if temperature dependent, 0 if not)
	Location 2	Specific storage type
	141	Permeability dependent on PoW normal strain (isotropic)
	142	Permeability dependent on PoW shear strain (isotropic)
	143	Permeability dependent on PoW normal and shear strain (isotropic)
	144	Permeability dependent on PoW normal strain (anisotropic)
	145	Permeability dependent on PoW shear strain (anisotropic)
	146	Permeability dependent on PoW normal and shear strain (anisotropic)

Notes

1. This tag is only used in the implicit flow data file.

2. For isotropic models, the permeability will be modified in all directions. For anisotropic models, the permeability will only be modified along the plane defining the PoW, and then transferred into the global coordinate system.

Data Format

The properties for the fracturing liquids and proppant are contained in *.use* files, which must be named with the prefix **TGR_.** Each *.use* file may contain multiple material property sets.

Properties for Fracturing Fluid and Flow Properties

The fracturing fluid and flow properties reside in the implicit data file. The format of the file is shown overleaf. The data is in the standard format for an Elfen data file, with identifiers for each set of properties and for the subsets within the property set for each material. In the extract overleaf, note that annotations in purple on the right hand side are for information only and do not appear in the *.use* file.

Each fluid has the following types of properties:

- flow properties
- permeability properties
- storage properties
- consolidation properties

```
material_data {  1                                                    Start of property set

 material_name {
 "Slick Water"
 }
# Flow model data
# ############################
  Liquid_viscosity {
    1.67e-03
  }

# Permeability Model Data
# ############################
  Network_flow_material_flags   { 2
    0  5
  }

# Storage Model Data
# ############################
  Network_flow_storage_flags {  2
    0   1
  }
  Constant_specific_storage  { 1
    5E-11
  }
  Factor_for_network_flow_storage {
     0.5
     }

# Closed fracture conductivity
# ############################
  Network_residual_conductivity {
    1.0E-5
  }

# Fluid_consolidation_properties
# ##############################
  Liquid_bulk_modulus {
    2e9
  }
  Liquid_density {
    1.00E+03
  }
  Leakoff_type { 1
    1
  }
  C1_coefficient {
    1e-007
  }
  C2_coefficient {
    1e-007
  }
  Leakoff_storage_type {
    1
  }

}                                                                     End of property set
```

Tags for Fracturing Fluid and Flow

Name	Dimensions			Requirement
	I	J	K	
Network_flow_material_flags	2			Compulsory
Network_flow_properties	PRPNET			Optional
Constant_network_permeability	-			Optional
Liquid_viscosity	-			Optional
Network_flow_storage_flags	2			Compulsory
Network_flow_storage_properties	PRPSTO			Optional
Constant_specific_storage	-			Optional
Fracture_normal_stiffness	-			Optional
Liquid_bulk_modulus	-			Compulsory
Network_residual_conductivity	-			Compulsory
Liquid_density	-			Compulsory
Fluid_material_flags	NFGELA			Optional
Fluid_properties	NMPRP			Optional
Fracture_roughness	-			Optional
Leakoff_type	1			Compulsory
C1_coefficient	-			Optional
C2_coefficient	-			Optional
Cw_coefficient	-			Optional
Constant_ leakoff_coefficient	-			Optional
Initial_volume_loss_spurt_time	2			Optional
Time_exposed_to_fracture_fluid	-			Optional
Formation_damage_perm_multiplier	-			Optional
Leakoff_storage_type				Optional

Table TGT.4 List of Tags for Fracture Fluid Flow

> ***Note :*** These tags are all found under *Material_data*.

Name **Network_flow_material_flags**

Type Integer vector

Dimensions NFGNET Number of network flow material flags (=2)

Description Flags for network flow material properties.

Location 1 Temperature function number
(1 if temperature dependent, 0 if not)

Location 2 Network flow material model type

3 Constant hydraulic conductivity

5 Cubic law of hydraulic conductivity with maximum aperture cutoff

---

Name **Network_flow_properties**

Type Real vector

Dimensions NPRNET Number of network flow properties (model dependent)

Description Network flow material properties (see Table TGT.5).

Model No.	*Model Type*	*Material Properties*	
3	Constant hydraulic conductivity	k	Permeability
		μ	Dynamic viscosity
		g	Gravitational acceleration
5	Cubic law of hydraulic conductivity with maximum aperture cutoff	α	1.0
		μ	Dynamic viscosity
		g	Gravitational acceleration

Table TGT.5 Properties for Network Flow Types

Name **Constant_network_permeability**

Type Real variable

Dimensions -

Description Intrinsic network permeability (required for network hydraulic conductivity type 1).

Name **Liquid_viscosity**

Type Real variable

Dimensions -

Description Viscosity of liquid.

Name	**Network_flow_storage_flags**
Type	Integer vector
Dimensions	NFGSTO Number of specific storage flags (=2)
Description	Flags for specific storage properties.
	Location 1 Temperature function number
	0 Not Temperature-dependent
	1 Temperature-dependent
	Location 2 Specific storage type
	1 Constant specific storage
	2 Aperture dependent specific storage

Name	**Network_flow_storage_properties**
Type	Real vector
Dimensions	PRPSTO Number of specific storage properties
Description	Network element storage properties.
	Location 1 Constant specific storage coefficient (storage type 1)
	Location 2 Normal stiffness of the fracture medium (storage type 2)
	Location 3 Compressibility of the fluid in the fracture medium (storage type 2)
	Location 4 Residual aperture in the fracture (storage types 1 & 2)
	Location 5 Maximum aperture (storage types 1 & 2) (only used if *Network_flow_material_flags=5)*

Notes

1. If specific storage type 1 is defined, then specific storage properties 1 and 4 need to be defined.

2. If specific storage type 2 is defined, then specific storage properties 2, 3 and 4 need to be defined.

3. Property 5 need to be defined only if *Network_flow_material_flags = 5*

Name	**Constant_specific_storage**
Type	Real variable
Dimensions	-
Description	Specific network storage (required for network storage type 1).

Name	**Fracture_normal_stiffness**
Type	Real variable
Dimensions	-
Description	Normal stiffness of fracture.

Name **Liquid_bulk_modulus**

Type Real variable

Dimensions -

Description Bulk modulus of liquid.

Name **Network_residual_conductivity**

Type Real variable

Dimensions -

Description Residual hydraulic conductivity of network element.

Name **Liquid_density**

Type Real variable

Dimensions -

Description Density of liquid.

Name **Fluid_material_flags**

Type Integer vector

Dimensions NFGFLA Number of fluid material flags (normally 4)

Description Flags for fluid material properties.

Location 1 Temperature function number
(1 if temperature dependent, 0 if not)

Location 2 Fluid material model type
- 1 Newtonian fluid
- 2 Power Law fluid
- 6 Herschel-Bulkley fluid (Type 1)

Location 3 0 (not used)

Location 4 0 (not used)

Name **Fluid_properties**

Type Real vector

Dimensions NPRFLU Number of fluid properties (model dependent)

Description Fluid material properties.

For Newtonian fluid:

Location 1 Alpha for upwind terms (=1 for fracture flow)

Location 2 Viscosity

For Power Law:

Location 1 Alpha for upwind terms (=1 for fracture flow)

Location 2 Consistency coefficient K

Location 3 Power law exponent n

Location 4 Critical shear rate for low strain rate viscosity

For Herschel-Bulkley:

Location 1 Alpha for upwind terms (=1 for fracture flow)

Location 2 Consistency coefficient K_1

Location 3 Power law exponent n_1

Location 4 Critical shear rate for low strain rate viscosity

Location 5 Consistency coefficient K_2

Location 6 Power law exponent n_2

Name **Fracture_roughness**

Type Real value

Dimensions -

Description Fracture surface roughness.

Name **Leakoff_type**

Type Integer vector

Dimensions 1

Description Leakoff type flag.

1 Two-term leakoff model

2 Three-term leakoff model

3 Constant leakoff model

Name **C1_coefficient**

Type Real variable

Dimensions -

Description C_1 leakoff coefficient for leakoff types 1 & 2.

Name **C2_coefficient**

Type Real variable

Dimensions -

Description C_2 leakoff coefficient for leakoff types 1 & 2.

Name **Cw_coefficient**
Type Real variable
Dimensions -
Description C_w leakoff coefficient for leakoff type 2.

Name **Constant_leakoff_coefficient**
Type Real variable
Dimensions -
Description Constant leakoff coefficient for leakoff type 3.

Name **Initial_volume_loss_spurt_time**
Type Real vector
Dimensions 2
Description For constant leakoff (type 3).

Location 1	Volume of fluid loss in establishing the filter cake per unit area
Location 2	Time associated with the transient phase of fluid loss

---

Name **Time_exposed_to_fracture_fluid**
Type Real variable
Dimensions -
Description Time at which leakoff starts. If not defined, this will be taken as the time when the new fracture is generated.

Name **Formation_damage_perm_multiplier**
Type Real variable
Dimensions -
Description Formation damage permeability multiplier f_d.for cleanup.

Name **Leakoff_storage_type**
Type Integer variable
Dimensions -
Description Leakoff storage method

0	Leakoff into formation (default)
1	Leakoff into storage block
