SMOKE SHADER MANUAL

CAUTION:

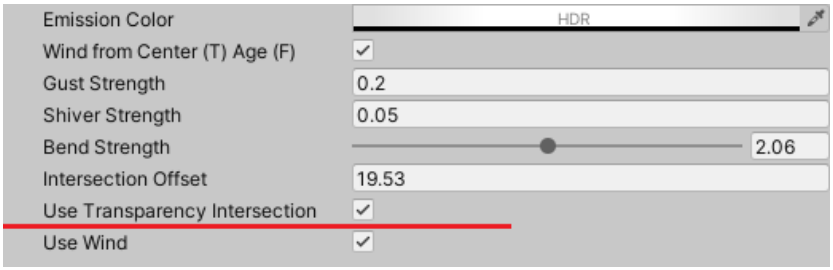
Unity HD, URP , Standard import:

- If you import asset into HD RP please import HD RP support pack from “HD and URP Support Packs Smoke and Fire” folder. It will replace prefabs, materials and shaders directly for your engine and hd rp version.

- If you import asset into URP please import URP support pack from “HD and URP Support Packs Smoke and Fire” folder. It will replace prefabs, materials and shaders directly for your engine and URP version.

If you want to use particles at mobiles:

1. Try to use Unlit variants - they are cheaper.
2. **Turn off** transparency intersection for unity standard render at every used material, it works at URP normally.



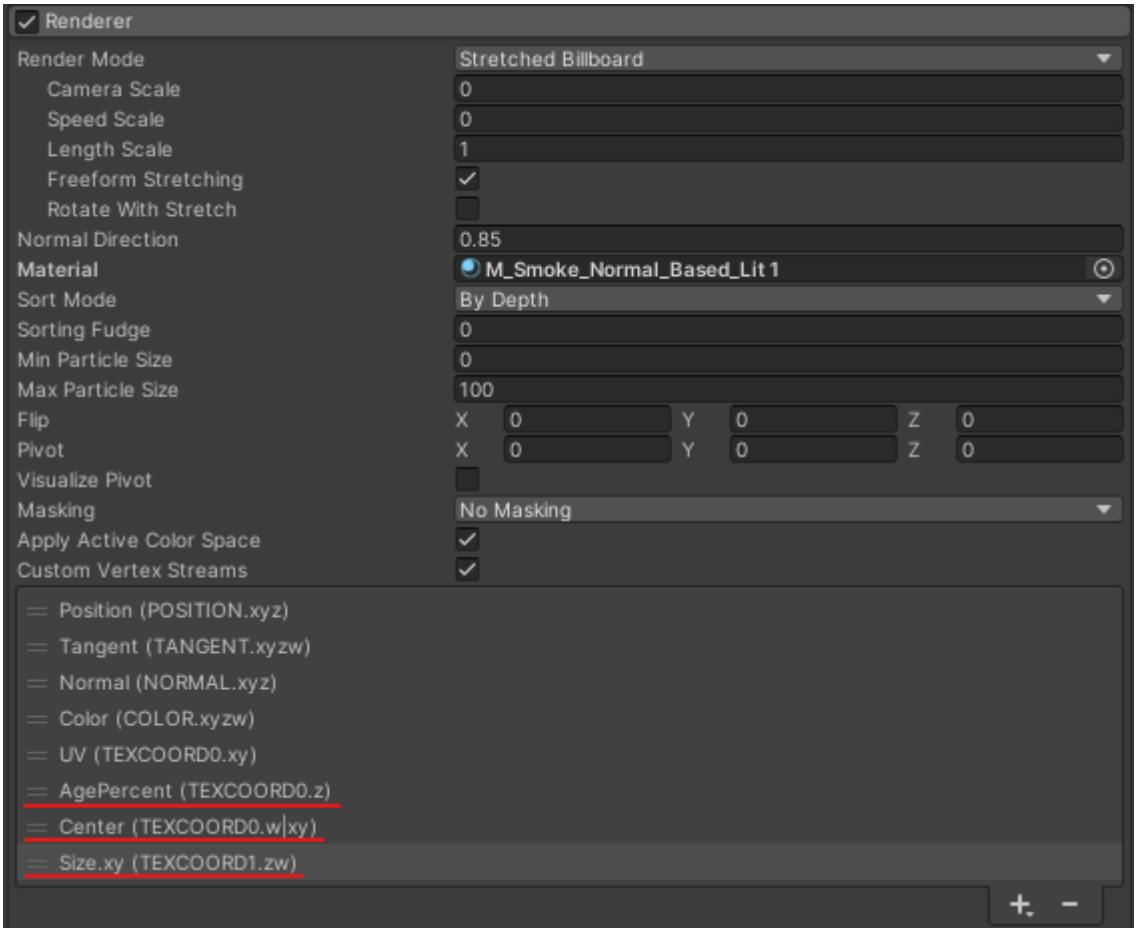
3. Remember that emissive materials activate emission if there is bloom post process at scene

If you build own particle with our shading:

1. For proper normal/ light calculation, add to the particle Custom Vertex Stream (in Renderer) **Tangent (TANGENT.xyzw)**

2. For use of the emission over time gradient in material, add to the particle Custom Vertex Stream (in Renderer) **AgePercent (TEXCOORD0.z)**

3. For use of the wind, add to the particle Custom Vertex Stream (in Renderer) **AgePercent (TEXCOORD0.z), Center (TEXCOORD0.w|xy) and Size.xy (TEXCOORD1.zw)**
4. **Make sure to place Custom Vertex Streams in order shown below:**



1. Shaders:

Our smoke shaders can be used for creating smoke, mist, fire and explosion vfx. They divide into two categories:

a) Based on lightmaps (**Smoke_Lightmap_Based_Lit** and **Smoke_Lightmap_Based_Unlit**)
b) Based on normals (**Smoke_Normal_Based_Lit** and **Smoke_Normal_Based_Unlit**)

Both shaders support one Directional Light, but for the Lit Shaders any additional light source, which is supported by the Standard Unity's Shaders, can be added, although with an influence simplified to the basic properties (i.e., Object Normals, Normal Maps, Ambient Occlusion, Smoothness and Metallic).

A. Shaders based on lightmaps:

These shaders are calculating light data by the use of lightmaps baked from volumetrics from six directional lights (front, back, left, right, top and bottom) according to the Unity's Directional Light (Color and Direction) or specified Direction.

B. Shaders based on normals:

These shaders are calculating light data from object's normals and tangent normal maps according to the Unity's Directional Light (Color and Direction) or specified Direction.

Shaders from left: Lightmap Based Lit, Lightmap Based Unlit, Normal Based Lit, Normal Based Unlit.

C. Comparison

The result of both shaders are similar, as can be seen below:

Lightmap Based Material

Normal Based Material

As normal maps are more common textures, Normal Based Materials can be easier to use, but they are more costly and produce less reliable results with occasional artifacts. On the other hand, because they do not strictly depend on baked lightmaps, they can generate “softer” smoke with full shading intact, as below:

Lightmap Based Material

Normal Based Material

However, using lightmaps have an advantage of specifying the result for each lighting direction separately, which can be used e.g. for faking translucency:

Lightmap Based Material

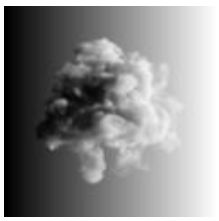
Normal Based Material

2. Used Texture Inputs:

a. Lightmap Based Shaders:

- **Lightmap Right(R) Left(G) Top(B) Bottom(A) – Prefix „_LM_R_L_T_B”:**

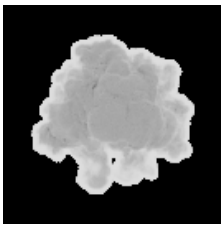
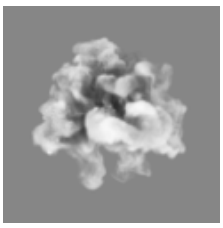
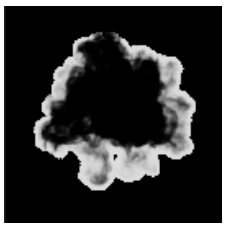
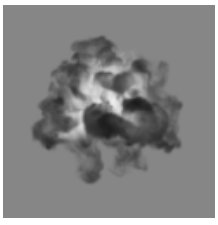
This lightmap contains on its channels baked directional lights pointing from named directions.

Channel	Red	Green	Blue	Alpha
Light direction	From right to left	From left to right	From top to bottom	From bottom to top
Example				

- **Lightmap Front(R) Back(G) Emission(B) Transparency(A) – Prefix „_LM_F_B_E_M”:**

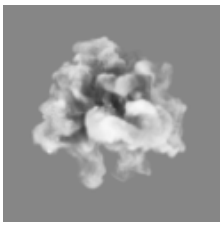
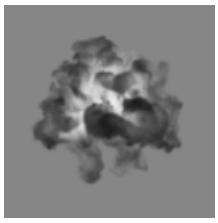
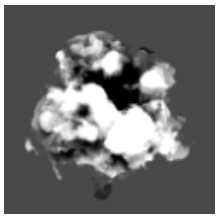
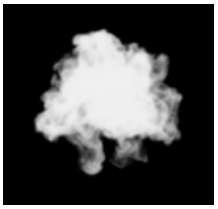
This lightmap contains:

- Red and green channels - directional lights pointing from named directions, although for better visual results, they can be replaced with an average and inversed average of the other sides (artistically enhanced) – see comparison below:

Light type	From camera	Average (lightened)	To camera	Inversed average (darkened)
Comparison				

- Blue channel – emission mask (baked for explosions or made from front lightmaps for smokes),

- Alpha channel – transparency mask.

Channel	Red	Green	Blue	Alpha
Content	Light from front	Light from back	Emission mask	Transparency mask
Example				

b. Normal Based Shaders:

- **Color Mask (R) Emission (B) Transparency (A) - Prefix „_BC_E_M”:**

This texture contains exactly the same inputs as the above „Lightmap Front(R) Back(G) Emission(B) Transparency(A)”, excluding blue channel:

- Red channel – mask map for color blend / additional detail – for this we use the same input as the front lightmap,

- Green channel – empty,

- Blue channel - emission mask (baked for explosions or made from front lightmaps for smokes),

- Alpha channel – transparency mask.

- **Normal Map – Prefix „_N”:**

This texture contains an OpenGL tangent normal map input (standard normal map for Unity). Our inputs were created from lightmaps’ data, but any normal map input would do.

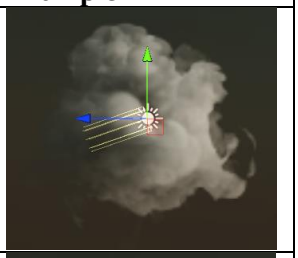
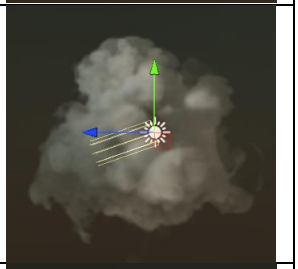
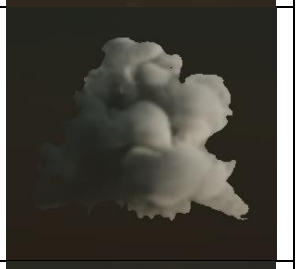
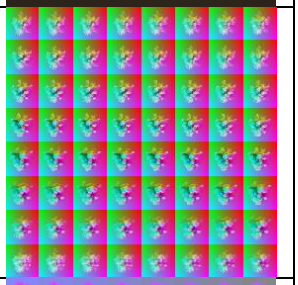
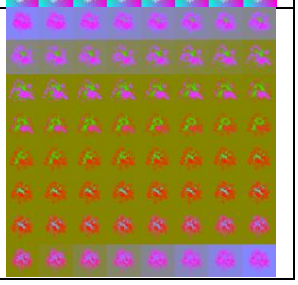
c. Emission gradients:

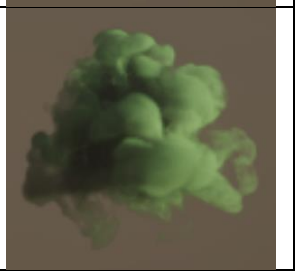
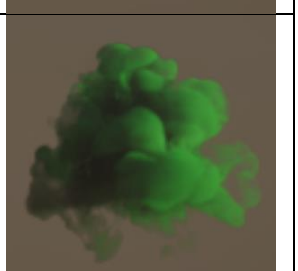
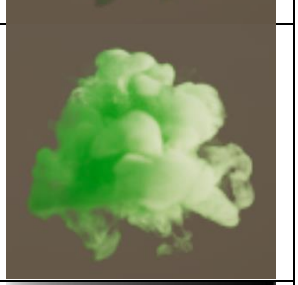
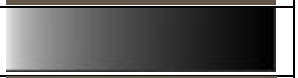
Emission gradients are used for sampling light data to emission (see Procedural Emission Property).

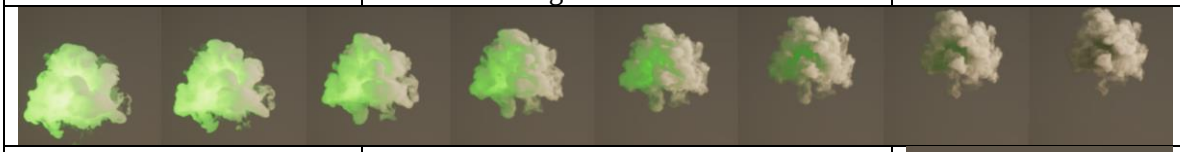
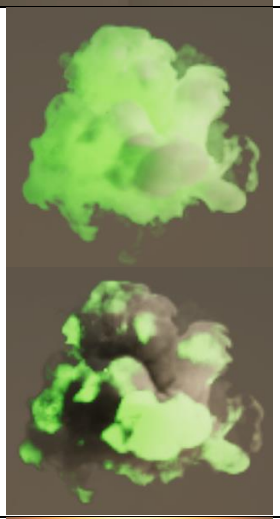
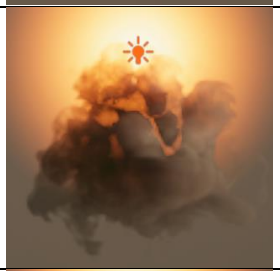
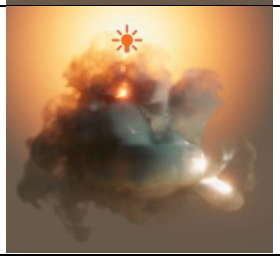
Caution: for proper working, set **Wrap Mode** to **Clamp**.

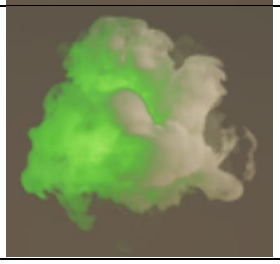
3. Shader properties:

a. Lightmap based shaders:

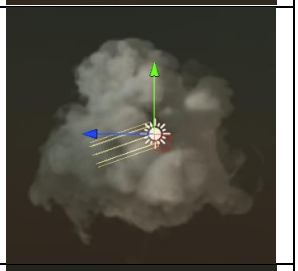
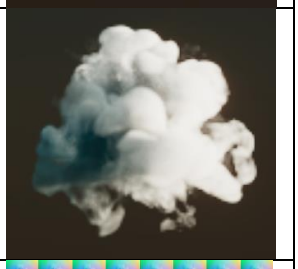
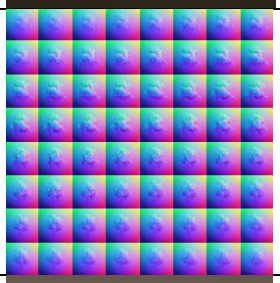
Property	Description	Example
Use Scene Light's Direction	Enable the checkbox to use **Scene Directional Light's Rotation** to calculate material's shading. (Requires **Directional Light** on the scene).	
Light Direction	With **Use Scene Light's Direction Property <u>disabled</u>**, this vector will specify light direction to calculate material's shading.	
Alpha Clip Threshold	This value, through the transparency mask, determines whether the pixel should be rendered or not.	
Alpha Multiplier	Set this value to strengthen or weaken transparency mask (useful mostly for Additive Transparency Blending Mode)	
Lightmap Right(R) Left(G) Top(B) Bottom(A)	This Texture input is used to calculate part of the shading data. See the **Used Texture Inputs** chapter for more details.	
Lightmap Front(R) Back(G) Emission(B) Transparency(A)	This Texture input's Red and Green channels are used to calculate part of the shading data. Blue channel controls the emission if specified in property below (**Emission From R (T) From B (F)**) Alpha channel controls the opacity. See the **Used Texture Inputs** chapter for more details.	

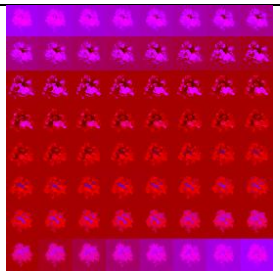
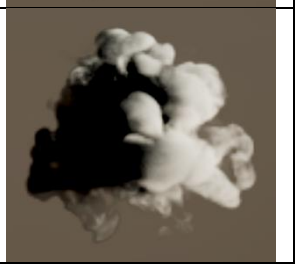
Light Intensity	This value controls the brightness of lighting.	
Light Contrast	This value controls the contrast between illuminated and shaded parts of the material.	
Light Blend Intensity	This value controls blend between the **Scene Directional Light's Color** and **Light Color Property** below.	
Light Color	Set this color to blend it with **Scene Directional Light's Color** by the **Light Blend Intensity** factor.	
Shadow Color	This color will set the color of the material's shadow.	
Emission Gradient	This Texture input is used for sampling emission to shading data.	
Emission Color	This HDR color determine the color and intensity of the emission.	
Emission Over Time	This value determines the end of the emission over the lifetime of the particle.	
		

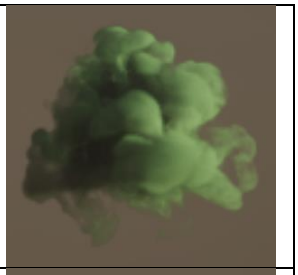
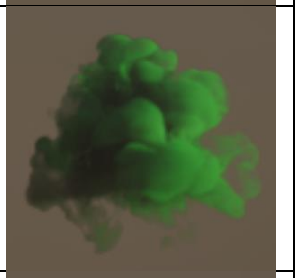
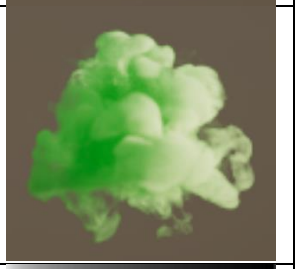
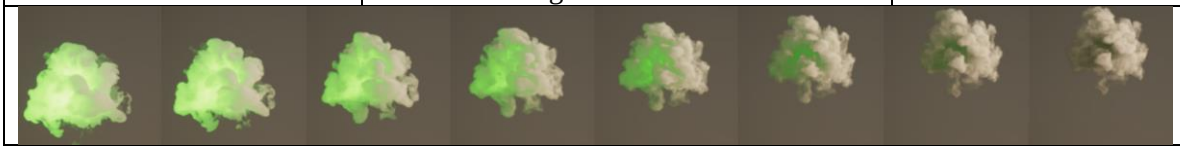
Emission Gradient Contrast	This value controls the length of the emission fading.	
		
Emission From R (T) From B (F)	With this checkbox **enabled**, for the emission mask will be used the **Red** channel from the **Lightmap Front(R) Back(G) Emission(B) Transparency(A)** texture**.** With this checkbox **disabled**, for the emission mask will be used the B**lue** channel from the **Lightmap Front(R) Back(G) Emission(B) Transparency(A)** texture. *For this checkbox to work, **disable** the **Emission Procedural (T) Mask (F)** property**.***	
Normal Map Strength	This value controls the normal intensity. For the normal to work, **enable Use Normal Map** property.	
Ambient Occlusion	This value defines the ambient occlusion.	
Smoothness	This value defines the smoothness.	
Metallic	This value defines the metallic.	

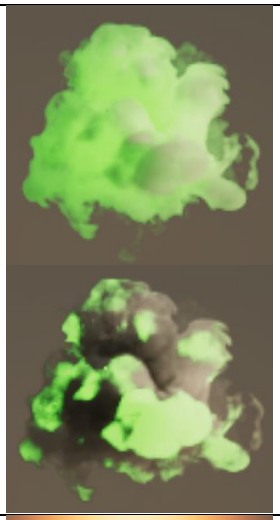
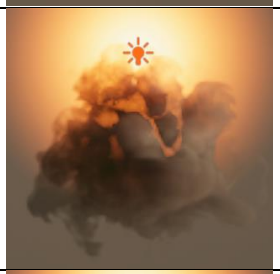
Intersection Offset	This value defines the distance between the particle and other objects from which it'll start to decrease the particle's alpha.	
Culling Start	This value will set the distance between a particle and the camera, to which a particle won't be rendered.	
Culling Distance	This value controls the fading distance before a particle will be culled.	
Use Transparency Intersection	Enable the checkbox to decrease the alpha value of a particle on intersection with other objects.	
Use Normal Map	Enable the checkbox to calculate tangent space normal map from lightmaps. *This calculated tangent normal is approximate and may produce some minor artifacts.*	
Emission Procedural (T) Mask (F)	Enable the checkbox to generate emission from material's shading. Disable the checkbox to generate emission from mask (**Emission From R (T) From B (F)** property).	

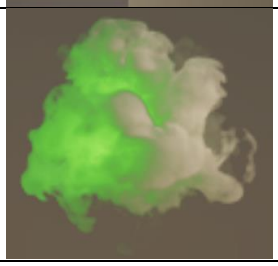
b. Normal based shaders:

Property	Description	Example
Use Scene Light's Direction	Enable the checkbox to use **Scene's Directional Light's Rotation** to calculate material's shading. (Requires **Directional Light** on the scene).	
Light Direction	With **Use Scene Light's Direction Property <u>disabled</u>**, this vector will specify light direction to calculate material's shading.	
Alpha Clip Threshold	This value, through the transparency mask, determines whether the pixel should be rendered or not.	
Alpha Multiplier	Set this value to strengthen or weaken transparency mask (useful mostly for Additive Transparency Blending Mode)	
Normal Map	This Texture input is used to calculate the shading data and defines tangent normal map. See the **Used Texture Inputs** chapter for more details.	
Normal Map Light Impact	This value controls how intensively the **Normal Map** input will affect the shading.	

Color Mask (R) Emission (B) Transparency (A)	With **Read Color Mask** checkbox **enabled**, this Texture input's Red channel will be used as a mask for blending color from **Particle Color (RGB) Alpha (A)** property. Blue channel controls the emission if specified in property below (**Emission From R (T) From B (F)**) Alpha channel controls the opacity. See the **Used Texture Inputs** chapter for more details.	
Read Color Mask	Enable the checkbox to use color mask (Red channel from **Color mask (R) Emission (B) Transparency (A)** input).	
Particle Color (RGB) Alpha (A)	This color defines the material's color and alpha. If the **Read Color Mask** property is enabled, **Particle Color (RGB)** will be blended with **Color Mask (R)** by the **Color Blend** factor below.	
Color Blend	With **Read Color Mask** checkbox **enabled**, this value controls the blend between **Color Mask (R)** and **Particle Color (RGB)**.	
Light Intensity	This value controls the brightness of lighting.	
Light Contrast	This value controls the contrast between illuminated and shaded parts of the material.	

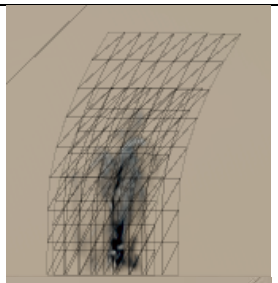
Light Blend Intensity	This value controls blend between the **Scene Directional Light's Color** and **Light Color Property** below.	
Light Color	Set this color to blend it with **Scene Directional Light's Color** by the **Light Blend Intensity** factor.	
Shadow Color	This color will set the color of the material's shadow.	
Emission Gradient	This Texture input is used for sampling emission to shading data.	
Emission Color	This HDR color determine the color and intensity of emission.	
Emission Over Time	This value determines the end of the emission over the lifetime of the particle.	
		
Emission Gradient Contrast	This value controls the length of the emission fading.	
		

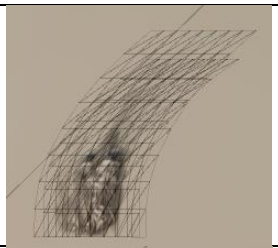
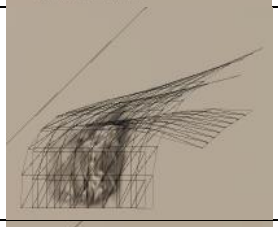
Emission From R (T) From B (F)	With this checkbox **enabled**, for the emission mask will be used the **Red** channel from the **Lightmap Front(R) Back(G) Emission(B) Transparency(A)** texture**.** With this checkbox **disabled**, for the emission mask will be used the B**lue** channel from the **Lightmap Front(R) Back(G) Emission(B) Transparency(A)** texture. *For this checkbox to work, **disable** the **Emission Procedural (T) Mask (F)** property.*	
Normal Map Strength	This value controls the normal intensity. For the normal to work, **enable Use Normal Map** property.	
Ambient Occlusion	This value defines the ambient occlusion.	
Smoothness	This value defines the smoothness.	
Metallic	This value defines the metallic.	
Intersection Offset	This value defines the distance between the particle and other objects from which it'll start to decrease the particle's alpha.	

Culling Start	This value will set the distance between a particle and the camera, to which a particle won't be rendered.	
Culling Distance	This value controls the fading distance before a particle will be culled.	
Use Transparency Intersection	Enable the checkbox to decrease the alpha value of a particle on intersection with other objects.	
Emission Procedural (T) Mask (F)	Enable the checkbox to generate emission from material's shading. Disable the checkbox to generate emission from mask (**Emission From R (T) From B (F)** property).	

4. Wind Properties:

TO USE THE WIND, ENABLE THE **"USE WIND"** CHECKBOX.

Wind from Center (T) Age (F)	Enable the checkbox to use the wind by the height from the particle base (calculated with the use of the Center Vertex Stream) – mostly useful for static meshes, as in the example on the right. Disable the checkbox to use the wind by the age of each particle. Useful for dynamic meshes where each particle should act individually, as in the example on the right.	 

Gust Strength	This parameter controls large gusts of wind, which will bend particles.	
Shiver Strength	This parameter controls small but strong gusts of wind, which will also highly distort the mesh.	
Bend Strength	This parameter controls blend between linear and geometrical influence of the wind on the particles.