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### How to calculate the flowrate of motive fluid in an ejector?

**Sampath Kumar R**

Upstream Process Engineer at Technip

Dear Friends,

In one of my ongoing projects, there is a requirement of ejectors which uses fuel gas as motive fluid. Process fluid has the pressure of 0.02 barg and this is to be pressurized upto 0.2 barg using the motive fluid in the ejector. Could anyone share your experiences on how to calculate the motive fluid flowrate for this application?

Thanks for your time.

Kind Regards

Sampath Kumar R

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**Saeid Rahimi Mofrad**

Senior Specialty Process Engineer at Fluor

Top Contributor

Sampath,

I had the same question couple of month age. See below link:

[http://www.linkedin.com/groups/Using-fuel-gas-as-motive-3822450.S.58700098?qid=1c7e2578-5150-430b-96d2-c669325d2263&trk=group\\_search\\_item\\_list-0-b-ttl&goback=%2Egmr\\_3822450](http://www.linkedin.com/groups/Using-fuel-gas-as-motive-3822450.S.58700098?qid=1c7e2578-5150-430b-96d2-c669325d2263&trk=group_search_item_list-0-b-ttl&goback=%2Egmr_3822450)

I searched a lot but found almost nothing, especially, when it comes to gas ejectors! There are lots of theoretical discussions about how ejectors work but not what a process engineer in EPC business is interested to see, practical and simple!

I tried to correlate the data I received from the gas ejector vendor with available steam ejector calculation charts but I failed. I guess you have to finally hang on vendors.

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Amir

**Amir Mofidi**

Sr. Process Engineer at Wintershall

I have developed a spreadsheet which calculates the motive fluid by iteration. I can search in my files and sent it to you

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ARIJIT

**ARIJIT SEN**

Proposal Engineer at Process Group International

Dear Sampath,

Below link can be useful for your problem.

[http://www.1877eductors.com/pdf/Pumping\\_Liquids\\_V2010.pdf](http://www.1877eductors.com/pdf/Pumping_Liquids_V2010.pdf)

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**Saeid Rahimi Mofrad**  
Senior Specialty Process Engineer at Fluor  
Top Contributor

Dear Arijit,

Thanks for the link. It is about pumping a liquid with the motive fluid (steam or liquid). I am wondering if you have something about pumping a gas with the motive gas (steam or FG)?

Regards  
Saeid

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**ARIJIT SEN**  
Proposal Engineer at Process Group International

Dear Saeid,

ARIJIT This will be helpful for you. Go to 6th page for your requirement.

<http://www.1877eductors.com/www.gaseductor.com.pdf>

Regards  
Arijit

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👍 Nooshin Harandi, Saeid Rahimi Mofrad and 1 other like this



**Hooman Tabaraei**  
Specialist Process Engineer (MIChemE, CEng)

Dear Sampath,

Hooman

Currently I was involved in a similar assignment for ejector sizing, and we did it by UNISIM, however we need to get confirmation from relevant vendor, CALTEC, for nozzles size. You can build it easily in HYSYS or UNISIM, to estimate HP (motive fluid) flow rate. Hope it helps you, pls, feel free to contact me if you need more information.

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**Sampath Kumar R**  
Upstream Process Engineer at Technip

Sampath

Dear Friends,

Thanks for your information.

Kind Attn: Mr.Hooman:- I checked the motive fluid requirement in HYSYS and it gives very high flowrate for the following conditions:

Process fluid inlet pressure = 0.02 barg

Process fluid outlet pressure = 0.2 barg

Process fluid flowrate = 1600 kg/hr

Motive fluid pressure = 15 barg

The flowrate of motive fluid is calculated (by HYSYS) is 31000 kg/hr which seems to be very high. Anyway, as you told, we need to rely on vendor only. No other go...

Thanks once again.

Kind Regards

Sampath Kumar R

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**Saeid Rahimi Mofrad**  
Senior Specialty Process Engineer at Fluor  
Top Contributor

Sampath

I guess you have used the gas ejector option in Hysys along with the default sizes for suction, motive and discharge nozzles (which are quite large) for your calculations.

The ejectors are strange equipment items. They are designed almost for a single point duty ( one

discharge pressure , one motive fluid pressure and suction condition) with a very narrow operating range. The compression is achieved through creating a very high velocity at the motive gas nozzle exit to reduce the pressure inside the ejector body low enough to suck the suction gas in. The motive gas nozzle (and in general ejector internals) is customized for the specified duty.

This means that if you don't correctly design/select the optimum size/model in your sizing calculation, you will end up with wrong results (basically high or low motive gas flow rate). In your case, you have used very large ejector for your application, that is why you need a high flow rate of motive gas in order to establish the required velocity at the nozzle.

In other words, for the case that you have specified above partially (as the motive and suction gas molecular weights a temperature also affect the motive gas flow calculation), you could compress the same amount of gas to the same discharge pressure with much lesser motive gas if you would have reduced the size of ejector in Hysys (especially the motive gas nozzle).

Hope it helps.

Saeid

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Prashant

### Prashant Yadav

Asst. Manager, Process Design

Dear Saied Rahimi and Samapath Kumar,

i had gone through same kind of problem and i found one equation for calculating the motive fluid (Steam ) in Ejector.

please go through it.

This equation is developed by Heat Exchanger Institute

$$W = 892.4 * Cd * Dn^2 * (Ps/Vg)^{0.5}$$

here

W= motive steam required (lb/hr)

Cd= Nozzle discharge coefficient

Dn= the nozzle throat diameter (in inch)

Ps= motive steam pressure at ejector , psia

Vg= motive steam specific volume (ft<sup>3</sup>/lb)

in my case ejector was working and i had to calculate the how much steam is going in. but in my case it was not able to get the value of Dn so i calculate the flow indirectly.

Please share your experience.

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