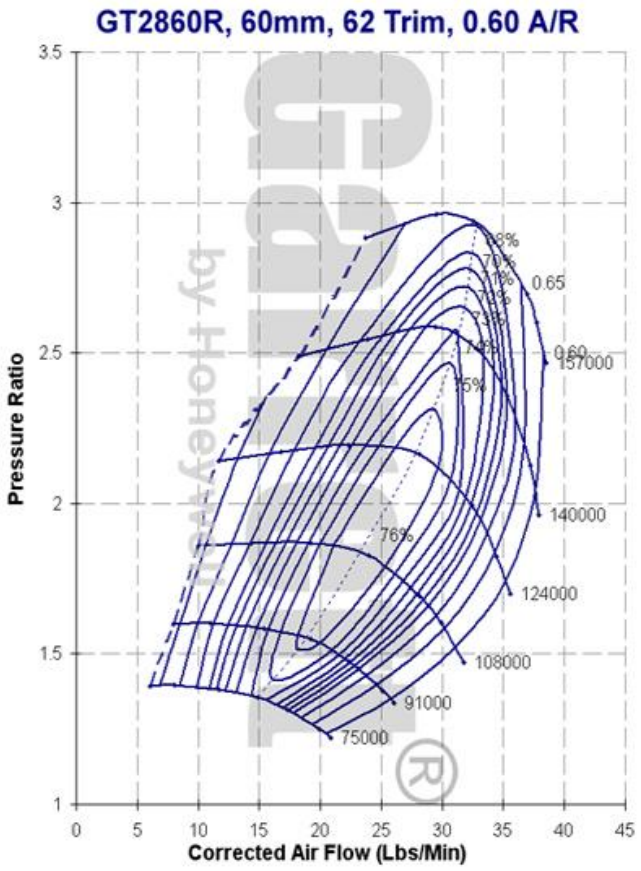
IHI-VF34 Turbo – Hybrid EJ20/EJ25

Re: FYI

Build: EJ205 Stock Heads on EJ257 bottom end

The IHI-VF34 turbo is equivalent to the Garrett 2860R Turbo. That implies the compressor flow is around 36lb/min, but been known to produce power on some engine mods on the JDM STI to 330whp. That's around 38lb/min and even as high as 40lb/min, but it is safe to say the turbo can produce power on a good efficient engine (engine Volumetric Efficiency (VE)) between 36-38lb/min (310whp – 330whp). That being said, please reviews the Garret compressor map below.



Turbo		Compressor				Turbine		
Turbo PN	CHRA PN	Ind Whl Dia(mm)	Exd Whl Dia(mm)	Trim	A/R	Whl Dia(mm)	Trim	A/R
739548-9	446179-66	47.20	60.10	62	0.60	53.90	76	0.86

When mapping the operating boost of the engine for tuning, you have to remember a few basic things:-

1. The engine volume is 2.5L
2. The cam response will be that of the EJ205 heads. The head flow will be that of the EJ205. The EJ207 heads which are STI heads will flow more than the EJ205 WRX heads. Reason being:-
    a. Head carries bigger ports – 2003+
    b. Bigger cam profile – more duration and more lift
3. Engine VE which is very important. Lower compression means lower VE. But VE can change due to pistons used, head cutting, squelch area, etc.
   Engine VE can be had from:
    a. MAF Tuning – Engine Load, MAP, IAT
    b. CarBerry – If tuned professionally where AFR's are correct - Speed Density Current Load(VE) Compensation* (Load Multiplier)

With the following information in mind, let's review the possible mapping.

Boost	15	16	17	19	20	22	24	25	26	28	29
PR	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0

CHP	WHP (est)	A/f	BFSC	Wa (lb/min)
400	350	10.9	0.55	40
380	330	10.9	0.55	38
360	310	10.9	0.55	36
340	290	10.9	0.55	34
320	270	10.9	0.55	32
300	250	10.9	0.55	30
200	150	10.9	0.55	20

$$Wa = HP * \frac{A}{F} * \frac{BSFC}{60}$$

Where:

Wa = Air flow actual (lb/min)

HP = Horsepower Target (flywheel)

A/F= Air/Fuel Ratio

BSFC/60= Brake Specific Fuel Consumption (lb/[hp*hr]) ÷ 60 (to convert from hours to minutes)

To calculate probable engine flow for the EJ205/EJ257 Hybrid engine, the following are stated:

$$Wa = \frac{MAP * VE * N/2 * Vd}{R * (460 + T_m)}$$

MAPreq = Manifold Absolute Pressure (psia) required to meet the horsepower target
Wa = Airflowactual(lb/min)
R = Gas Constant = 639.6
Tm = Intake Manifold Temperature (degrees F)
VE = Volumetric Efficiency
N = Engine speed (RPM)
Vd = engine displacement (Cubic Inches, convert from litres to CI by multiplying by 61.02, ex. 2.0 litres * 61.02 = 122 CI)

Conditions
Engine= 2.5L
Tm = 122F
Vd = 152.55ci

Boost – 15psi

Possible Engine VE

1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000
0.90	0.95	1.00	1.10	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.05	1.00	0.90

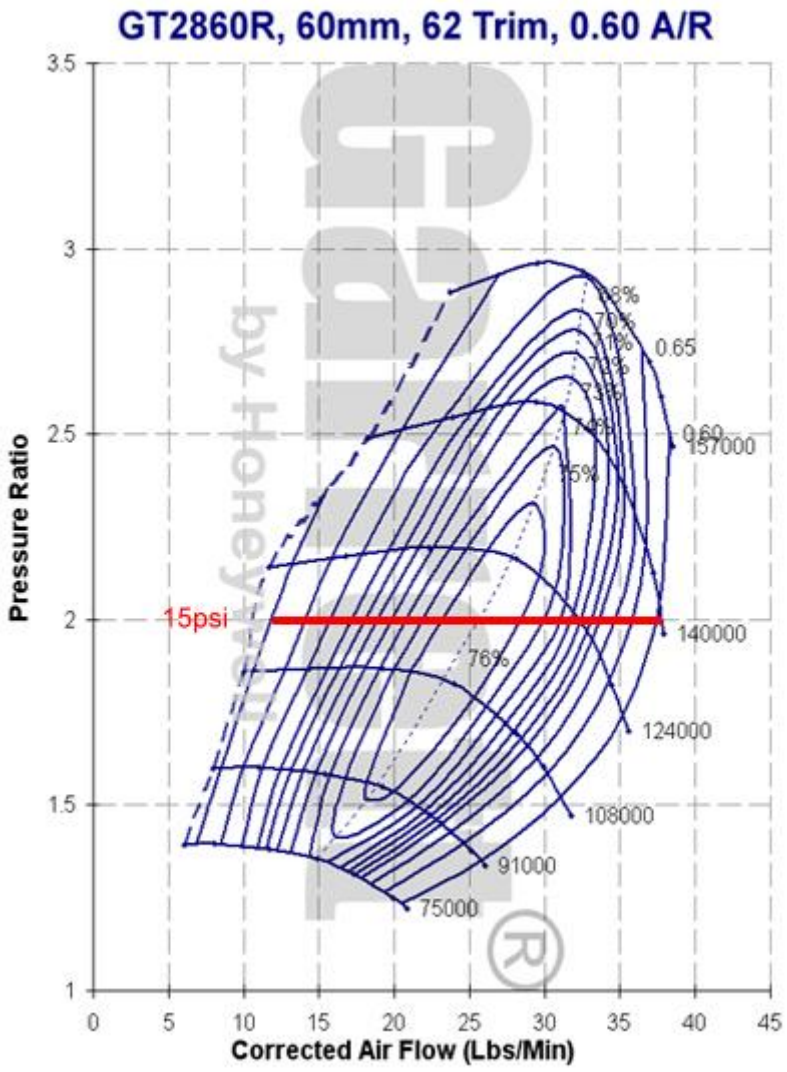
Possible engine flow

2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000
17	21	24	28	31	35	38	42	45	45	46	46

As you can see, 15psi is just right for the 2.5l engine on the IHI-VF34 turbo. Your engine cc capacity maybe a tab less that 2500cc, but at 5500rpm you are close to the peak flow of the compressor and continue to push on until 6000. Any increased of boost over 5000rpm will really be pushing the turbo harder, including the engine. If the boost is turned up before 5000rpm, good torque will be produce.

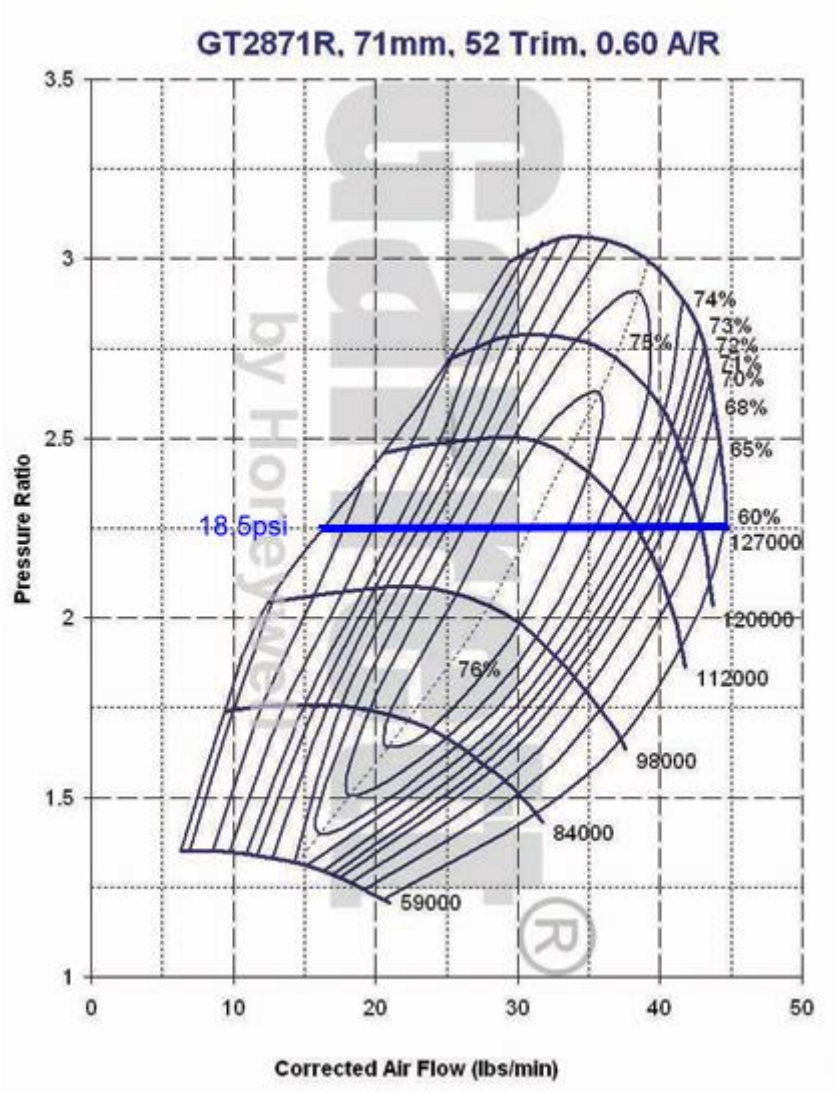
Again, engine VE is very important in the calculations. Please review page 4 for the 15psi line on the compressor map, which is the boost level for maximum turbo flow.

Lower VE implies you will need more boost to make more power


GT2860R, 60mm, 62 Trim, 0.60 A/R
Pressure Ratio
Corrected Air Flow (Lbs/Min)
3.5
3
2.5
2
1.5
1
0
5
10
15
20
25
30
35
40
45
15psi
0.65
0.60
157000
140000
124000
108000
91000
75000
76%
by Honeywell

Mapping for the FP 68HTA

The FP 68HTA like all old HTA compressors, always represent their Garrett big brothers and cousins to the GTX compressors. The HTA sits between the GT & GTX. Therefore the FP 68HTA sits between the GT2871R and the GTX2871R. It response is slower due to the Journal Bearing.



Turbo		Compressor				Turbine		
Turbo PN	**CHRA PN**	**Ind Whl Dia(mm)**	**Exd Whl Dia(mm)**	**Trim**	**A/R**	**Whl Dia(mm)**	**Trim**	**A/R**
472560-15	446179-67	51.20	71.00	52	0.60	53.90	76	0.64

In review of the GT2871R compressor map, the blue line highlights the point where the turbo will have maximum flow of close to 45lb/min. In tuning,

In tuning, I find the FP 68HTA to flow 44lb/min. You will soon see the 68HTA does not suit the 2.5L engine and its flow, especially with EJ205 heads which has flatter cam response to the EJ257 heads; and why many USA Tuners hates it and states it is not efficient on the engine when pushed. It is made to produce TQ on the engine and not horse power. Again, the compressor map does not suit the 2.5L.

I would recommend to you if you are going after TQ, sure. If not, you are better off with a 55+lb/min turbo.

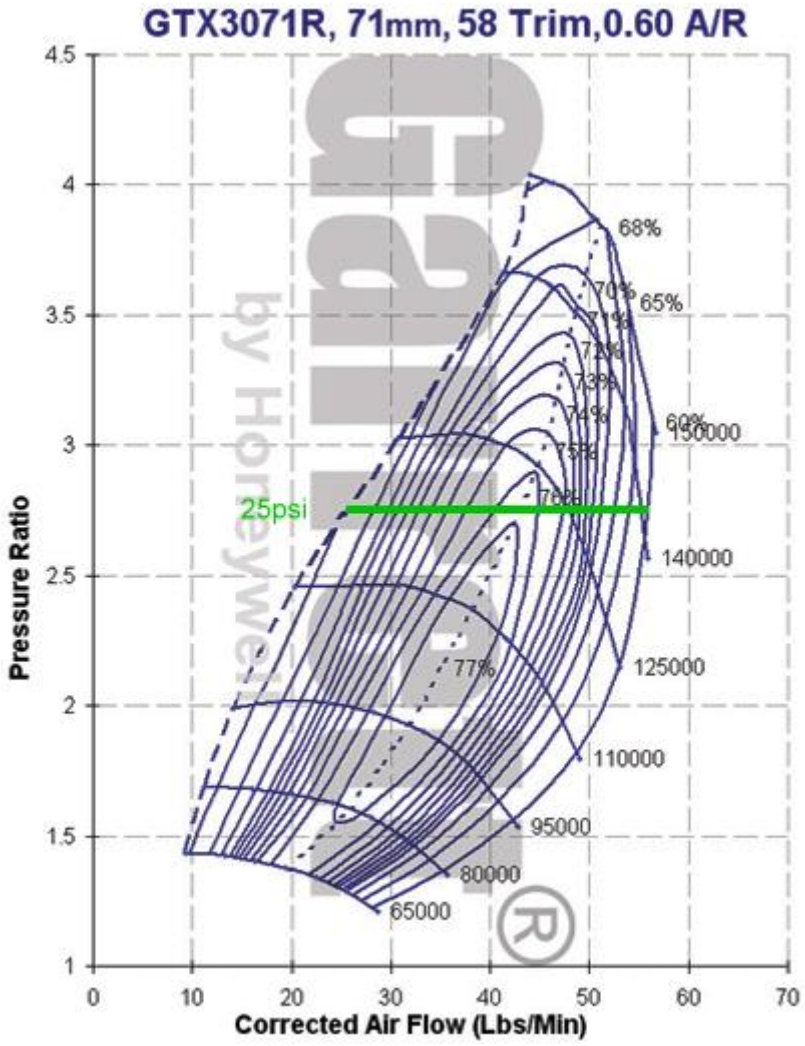
Possible engine VE

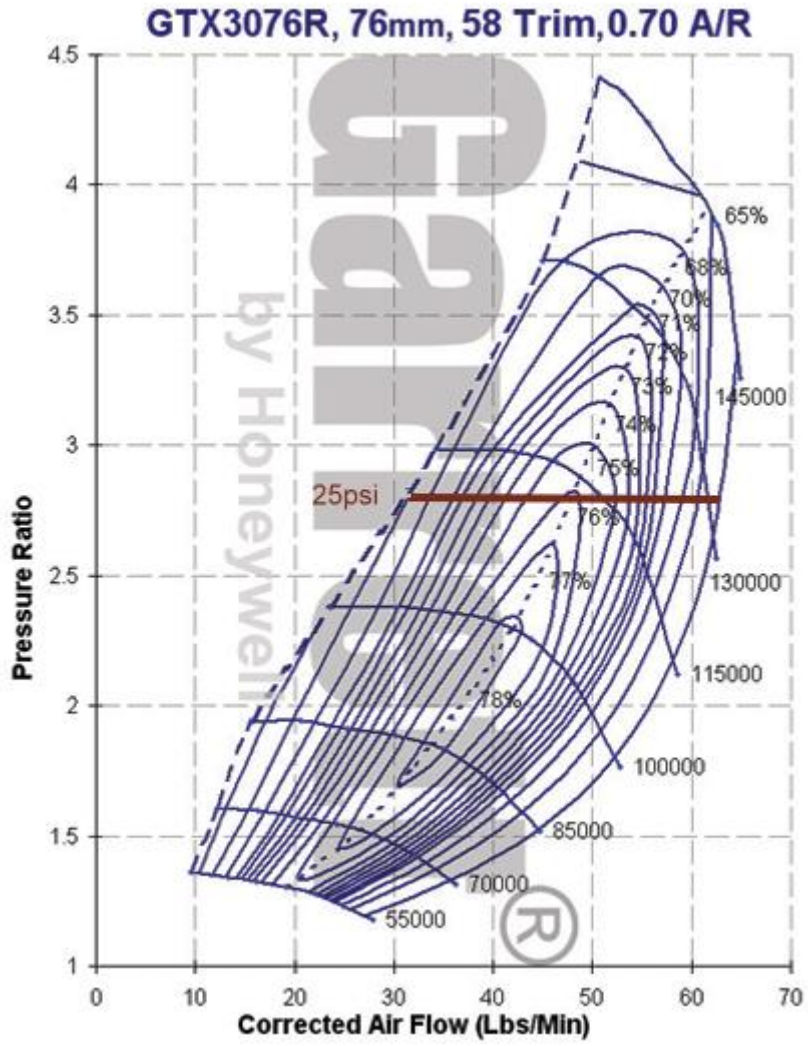
1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000
0.90	0.95	1.00	1.10	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.05	1.00	0.90

Possible engine flow @ 18.5psi

2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000
19	23	27	31	35	39	43	47	51	50	51	52

As you can see, the performance is like your IHI-VF34 turbo. Still the same 5500rpm limitation, but with a tab more power. It just doesn't worth it.


GTX3071R, 71mm, 58 Trim,0.60 A/R
Pressure Ratio
Corrected Air Flow (Lbs/Min)
4.5
4
3.5
3
2.5
2
1.5
1
0
10
20
30
40
50
60
70
25psi
68%
70%
65%
71%
72%
73%
74%
60%
150000
75%
76%
140000
77%
125000
110000
95000
80000
65000
by Honeywell


GTX3076R, 76mm, 58 Trim, 0.70 A/R
Pressure Ratio
Corrected Air Flow (Lbs/Min)
4.5
4
3.5
3
2.5
2
1.5
1
0
10
20
30
40
50
60
70
65%
68%
70%
71%
72%
73%
74%
75%
76%
77%
78%
25psi
145000
130000
115000
100000
85000
70000
55000
by Honeywell