

Наполнитель Greensand Plus

Greensand Plus - минерал (глауконит), на который искусственным путем нанесено специальное покрытие, содержащие диоксид марганца, который способен окислять содержащиеся в воде железо, марганец и сероводород. Сероводород удаляется в виде нерастворимых соединений серы. Образующиеся осадки задерживаются слоем фильтрующей загрузки и удаляются при обратной промывке. Для восстановления окислительной способности марганцевого зеленого песка следует провести его регенерацию слабым раствором перманганата калия. Рекомендуется своевременно проводить интенсивную обратную промывку фильтра (не дожидаясь полного истощения окислительной способности), а также перед вводом в эксплуатацию. Несвоевременное проведение регенерации приводит к сокращению срока службы марганцевого зеленого песка.

Марганцевый зеленый песок используется с периодической или постоянной схемой регенерации для восстановления окислительной способности. Восстановление окислительной способности загрузки проводится раствором перманганата калия или последовательной обработкой растворами хлора и перманганата калия. Оксид марганца при этом выступает как катализатор окисления, а также как буфер для исключения попадания перманганата калия в водопроводную магистраль потребителя.

При одновременном использовании хлора и перманганата калия хлор необходимо дозировать за 10-20 секунд до дозирования перманганата калия или как можно ближе к месту ввода; это обеспечит желаемый уровень остаточного хлора в очищенной воде. Если дозируется перманганат калия, необходимая доза перманганата калия должна окрашивать воду в светло-розовый цвет. Этот избыток перманганата калия или хлора, проходящий через фильтр, будет постоянно регенерировать зеленый песок.

Рекомендуемые дозы реагентов можно рассчитать по следующим уравнениям:

- при постоянной схеме дозирования хлора и перманганата калия:

$$CCI = CFe; CKMnO_4 = 0,2 \cdot CFe + 2 \cdot CMn;$$

- при постоянной схеме дозирования только хлора:

$$CCI = 1,0 \cdot CFe + 3 \cdot CMn;$$

где CCI – концентрация вводимого активного хлора, мг/л;

CFe – концентрация железа, мг/л; CKMnO₄ – концентрация вводимого перманганата калия, мг/л; CMn – концентрация в воде марганца, мг/л.

Преимущества:

- Широкий диапазон концентраций удаляемого железа
- Эффективное удаление сероводорода, железа и марганца
- Допускается присутствие в воде активного хлора
- Низкая истираемость



Технические характеристики

Общие характеристики

Код	13994
Назначение (материала)	Катализаторы
Цвет	Черный
Страна происхождения	США

Условия применения

Высота слоя	760 мм
Расширение слоя в режиме обратной промывки	20 %
Расход KMnO ₄ на регенерацию (min)	1.5 г/л материала
Расход KMnO ₄ на регенерацию (max)	2 г/л материала
Расширение слоя в режиме обратной промывки (max)	40 %
Минимальное "свободное пространство"	50 %

Требования к качеству исходной воды

Значение pH (max)	8,5
Содержание железа (max)	15 мг/л
Значение pH (min)	6,2
Содержание сероводорода (max)	5 мг/л
Температура воды (max)	26.7 C

Физические свойства

Удельный вес (max)	2.9 г/см ³
Размер гранул (min)	0.25 мм
Насыпная масса	1.36 г/см ³
Размер гранул (max)	1 мм
Ориентировочный ресурс	1,34 г железа, или 0,67 г марганца, или 0,27 г сероводорода
Эффективный размер гранул	0.3 мм
Коэффициент однородности	1.6
Удельный вес	2.4 г/см ³

Режим работы

Скорость потока в режиме фильтрации (min)	5 м/час
Скорость потока в режиме обратной промывки (max)	34 м/час
Скорость потока в режиме обратной промывки (min)	28 м/час
Скорость потока в режиме фильтрации (max)	12 м/час

GREENSAND^{plus}™

Performance Media for Water Filtration
Removes iron, manganese, hydrogen sulfide, arsenic and radium

Greensand^{Plus}™ is a black filter media used for removing soluble iron, manganese, hydrogen sulfide, arsenic and radium from groundwater supplies.

The manganese dioxide coated surface of **Greensand^{Plus}** acts as a catalyst in the oxidation reduction reaction of iron and manganese.

The silica sand core of **Greensand^{Plus}** allows it to withstand waters that are low in silica, TDS and hardness without breakdown.

Greensand^{Plus} is effective at higher operating temperatures and higher differential pressures than standard manganese greensand. Tolerance to higher differential pressure can provide for longer run times between backwashes and a greater margin of safety.

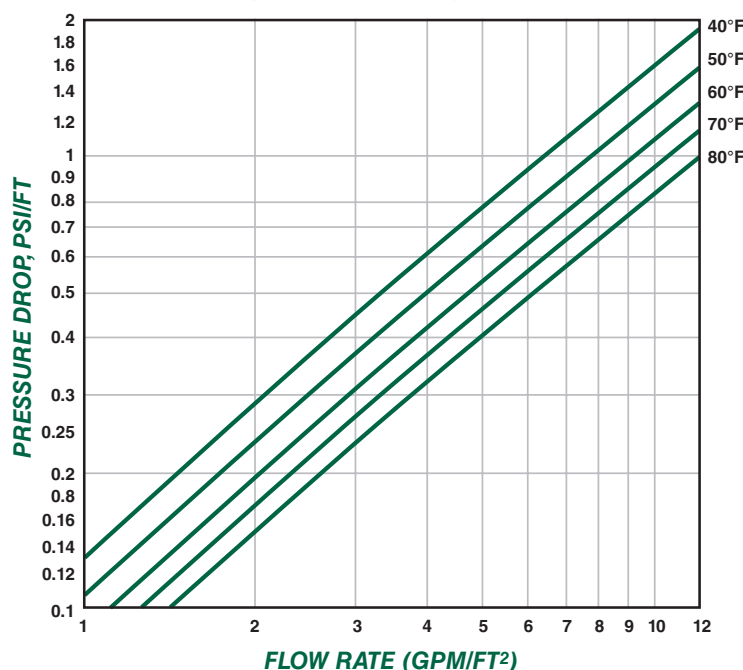
Systems may be designed using either vertical or horizontal pressure filters, as well as gravity filters.

Greensand^{Plus} is a proven technology for iron, manganese, hydrogen sulfide, arsenic and radium removal. Unlike other media, there is no need for extensive preconditioning of filter media or lengthy startup periods during which required water quality may not be met.

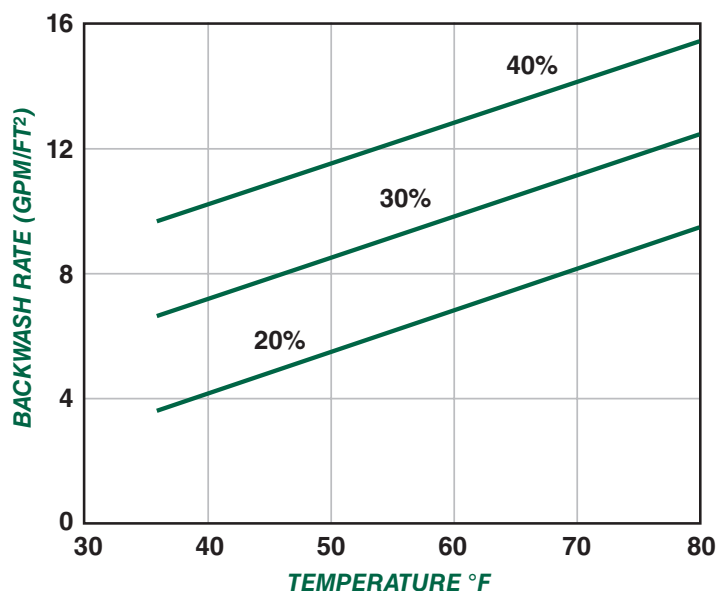
Greensand^{Plus} is an exact replacement for manganese greensand. It can be used in CO or IR applications and requires no changes in backwash rate or times or chemical feeds.

Greensand^{Plus} has the WQA Gold Seal Certification for compliance with NSF/ANSI 61. Packaging is available in 1/2 cubic foot bags or 1 metric ton (2,205 lbs) bulk sacks.

GREENSAND^{Plus} PRESSURE DROP (CLEAN BED)



BED EXPANSION DURING BACKWASHING



PHYSICAL CHARACTERISTICS

Physical Form

Black, nodular granules shipped in a dry form

Apparent Density

88 pounds per cu. ft. net (1410.26 kg/m³)

Shipping Weight

90 pounds per cu. ft. gross (1442.31 kg/m³)

Specific Gravity

Approximately 2.4

Porosity

Approximately 0.45

Screen Grading (dry)

18 x 60 mesh

Effective Size

0.30 to 0.35 mm



Uniformity Coefficient

Less than 1.60

pH Range

6.2 - 8.5 (see General Notes)

Maximum Temperature

No limit

Backwash Rate

Minimum 12 gpm/sq. ft. at 55°F (29.4 m/hr @ 12.78°C) (see expansion chart)

Service Flow Rate

2 - 12 gpm/sq. ft. (4.9m/hr - 29.4 m/hr)

Minimum Bed Depth

15 inches (381 mm) of each media for dual media beds or 30 inches minimum (762 mm) of GreensandPlus alone

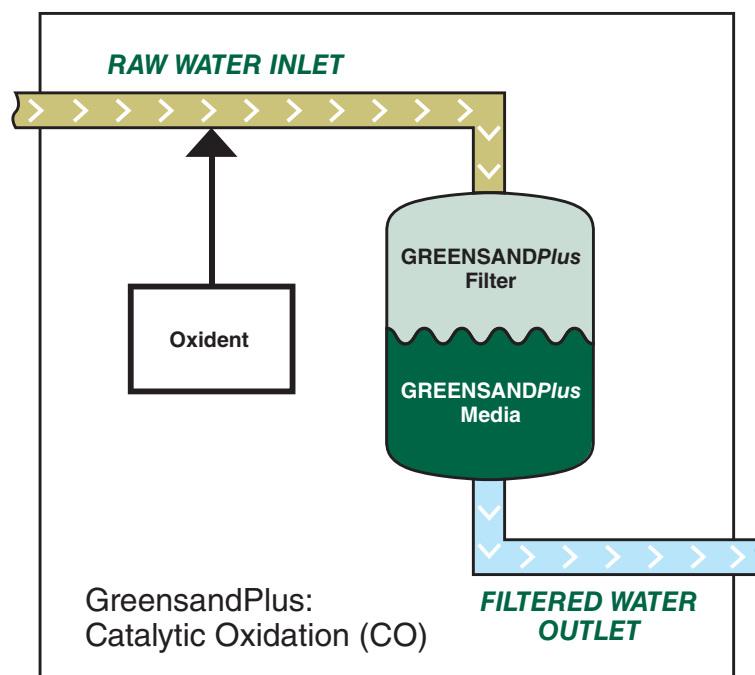
METHOD OF OPERATION (CO)

Catalytic Oxidation (CO) operation is recommended in applications where iron removal is the main objective in well waters with or without the presence of manganese. This method involves the feeding of a predetermined amount of chlorine (Cl₂) or other strong oxidant directly to the raw water before the GreensandPlus Filter.

Chlorine should be fed at least 10-20 seconds upstream of the filter, or as far upstream of the filter as possible to insure adequate contact time. A free chlorine residual carried through the filter will maintain GreensandPlus in a continuously regenerated condition.

For operation using chlorine, the demand can be estimated as follows:

$$\text{mg/L Cl}_2 = (1 \times \text{mg/L Fe}) + (3 \times \text{mg/L Mn}) + (6 \times \text{mg/L H}_2\text{S}) + (8 \times \text{mg/L NH}_3)$$



SUGGESTED OPERATING CONDITIONS

Bed Type

Dual media; anthracite 15-18 in. (381 mm-457 mm) and GreensandPlus 15-24 in. (381 mm - 610 mm)

Capacity

700-1200 grains of oxidized iron and manganese/sq.ft. of bed area based on oxidant demand and operation to iron break through or dp limitations.

Backwash

Sufficient rate using treated water to produce 40% bed expansion until waste water is clear, or for 10 minutes, whichever occurs first.

Air/Water Scour

Optional using 0.8-2.0 cfm/sq. ft. (15 m/hr -37 m/hr) with a simultaneous treated water backwash at 4.0-4.5 gpm/sq. ft. (9.8 m/hr - 11.03 m/hr)

Raw Water Rinse

At normal service flow rate for 3 minutes or until effluent is acceptable.

Flow Rate

Recommended flow rates with CO operation are 2-12 gpm/sq. ft. (4.9 m/hr - 29.4 m/hr). High concentrations of iron and manganese usually require lower flow rates for equivalent

run lengths. Higher flow rates can be considered with low concentrations of iron and manganese. For optimizing design parameters, pilot plant testing is recommended. The run length between backwashes can be estimated as follows:

What is the run length for a water containing 1.7 mg/L iron and 0.3 mg/L manganese at a 4 gpm/sq. ft. service rate:

Contaminant loading

$$= (1 \times \text{mg/L Fe}) + (2 \times \text{mg/L Mn})$$

$$= (1 \times 1.7) + (2 \times 0.3)$$

$$= (2.3 \text{ mg/Lor } 2.3/17.1 = 0.13 \text{ grains/gal. (gpg)})$$

At 1,200 grains / sq. ft. loading + 0.13 gpg = 9,230 gal./sq. ft.

At 4 gpm / sq. ft. service rate $9,230/4 = 2,307$ min.

The backwash frequency is approximately every 32-38 hours of actual operation.

*The Intermittent regeneration (IR) operation is available for certain applications.
Contact your Inversand representative for additional information.*

GENERAL NOTES

pH

Raw waters having natural pH of 6.2 or above can be filtered through **GreensandPlus** without pH correction.

Raw waters with a pH lower than 6.2 should be pH-corrected to 6.5-6.8 before filtration. Additional alkali should be added following the filters if a pH higher than 6.5-6.8 is desired in the treated water. This prevents the possible adverse reaction and formation of a colloidal precipitate that sometimes occurs with iron and alkali at a pH above 6.8.

Initial Conditioning of GreensandPlus

GreensandPlus media must be backwashed prior to adding the anthracite cap. The **GreensandPlus**

backwash rate must be a minimum of 12 gpm/sq. ft. @ 55 °F.

After backwashing is complete, the **GreensandPlus** must be conditioned. Mix 0.5 gal. (1.9 L) of 6% household bleach or 0.2 gal (0.75 L) of 12% sodium hypochlorite for every 1 cu. ft. (28.3 L cu. m) of **GreensandPlus** into 6.5 gallons (25 L) of water.

Drain the filter enough to add the diluted chlorine mix. Apply the diluted chlorine to the filter being sure to allow the solution to contact the **GreensandPlus** media. Let soak for a minimum of 4 hours, then rinse to waste until the "free" chlorine residual is less than 0.2 mg/L. The **GreensandPlus** is now ready for service.

GENERAL NOTES continued

Radium and Arsenic Removal Using GreensandPlus

The **GreensandPlus** CO process has been found to be successful in removing radium and arsenic from well water. This occurs via adsorption onto the manganese and/or iron precipitates that are formed. For radium removal, soluble manganese must be

present in or added to the raw water for removal to occur. Arsenic removal requires iron to be present in or added to the raw water to accomplish removal. Pilot plant testing is recommended in either case.

REFERENCES

USA

American Water Company, CA
San Jacinto, CA
City of Tallahassee, FL
Adedge Technologies, Inc., Buford, GA
City of Mason City, IL
City of Goshen, IN
City of Hutchinson, KS
City of Burlington, MA
Dedham Water Co., MA
Raynham Center, MA
Northbrook Farms, MD
Sykesville, MD
Tonka Equipment Company, Plymouth, MN

City of New Bern, NC
Onslow County, NC
Hungerford & Terry, Inc., Clayton, NJ
Fort Dix, NJ
Jackson Twp. MUA, NJ
Churchill County, NV
Suffolk County Water Authority, NY
City of Urbana, OH
Roberts Filter Group, Darby, PA

International

Watergroup, Saskatoon, SK Canada
BI Pure Water, Surrey, BC Canada
Sydney, Nova Scotia, Canada
PT Besflo Prima, Jakarta, Indonesia
Eurotrol, Milanese, Italy
Gargan Industrial, Mexico City, Mexico
Filtration Tech, Auckland, New Zealand
Alamo Water Poland, Izabelin, Poland
Aquatrol Company, Moscow, Russia
Impulse Group, St. Petersburg, Russia
Brenntag Nordic, Taby, Sweden
Nema Kimya, Istanbul, Turkey
Minh Tam, Ho Chi Minh City, Vietnam



The manufacturing of GreensandPlus is an ongoing, 24/7 process to ensure the highest quality water treatment media

Certifications

REACH Registration
01-2119452801-43-0020 for import to the EU

Certified by the WQA to NSF/ANSI/CAN 61
for material safety only, and to NSF/ANSI 372
for Lead Free

NSF Certified through the WQA



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Distributed by:

Inversand Company
SINCE 1925

ORIGINAL DEVELOPERS OF MANGANESE GREENSAND & GREENSANDPLUS

The information and recommendations in this publication are true and reliable to the best of our knowledge. These recommendations are offered in good faith but without warranty or liability for consequential damage as conditions and method of use of our products are varied and beyond our control. We suggest the user determines the suitability and performance of our products before they are adopted on a commercial scale.

H125/H151/H200M/H200/H300 GreensandPlus™ Filter Systems

MODEL	PIPE SIZE	CF MEDIA	TANK SIZE	WATER QUALITY			BACK WASH FLOW RATE**	DIMENSIONS¹					EST. SHIP WT. LBS.	CAPACITY ppm Fe Equivalent***	
				SUPERIOR	HIGH	UTILITY		TOTAL H	INLET I	OUTLET O	DRAIN D	WIDTH W		CR	IR
H125-GSP10-1	1.25	1	10x44v	2	2	3	7	51	46	46	50	11	150	10,900	5,000
H125-GSP10-1.5	1.25	1.5	10x54v	2	2	3	7	63	57	57	58	11	210	10,900	7,500
H125-GSP13-2.5	1.25	2.5	13x54v	3	4	5	11	63	57	57	58	14	350	18,400	12,500
H125-GSP14-3	1.25	3	14x65v	4	4	5	13	74	68	68	69	15	430	21,300	15,000
H125-GSP16-4	1.25	4	16x65v	5	6	7	17	74	67	70	68	17	550	27,900	20,000
H125-GSP18-5	1.25	5	18x65	6	7	9	20	76	68	71	69	19	740	35,300	25,000
H151-GSP14-3	1.5	3	14x65	4	4	5	13	74	68	69	70	15	430	21,300	15,000
H151-GSP16-4	1.5	4	16x65	5	6	7	17	74	68	69	70	17	560	27,900	20,000
H151-GSP18-5	1.5	5	18x65	6	7	9	20	76	69	70	71	19	750	35,300	25,000
H151-GSP21-7	1.5	7	21x62	8	10	12	30	72	65	67	67	22	1260	48,000	40,000
H151-GSP24-10	1.5	10	24x72	11	13	16	40	82	75	76	77	25	1490	62,800	60,000
H200M-GSP14-3	2	3	14x65	4	4	5	13	78	69	69	78	15	440	21,300	15,000
H200M-GSP16-4	2	4	16x65	5	6	7	17	78	39	69	78	17	570	27,900	20,000
H200M-GSP18-5	2	5	18x65	6	7	9	20	80	71	71	80	19	760	35,300	25,000
H200M-GSP21-7	2	7	21x62	8	10	12	30	80	71	71	80	22	1140	48,000	40,000
H200M-GSP24-10	2	10	24x72	11	13	16	40	88	79	79	88	25	1650	62,800	60,000
H200M-GSP30-15	2	15	30x72	17	20	25	60	89	80	80	89	31	2320	98,100	80,000
H200-GSP24-10	2	10	24x72	11	13	16	40	89	83	87	85	25	1690	62,800	60,000
H200-GSP30-15	2	15	30x72	17	20	25	60	86	80	84	82	31	2350	98,100	80,000
H200-GSP36-20	2	20	36x72	25	28	35	85	87	81	85	83	37	3140	141,300	110,000
H300-GSP36-20	3	20	36x72	25	28	35	85	104	76	96	100	37	3210	141,300	110,000
H300-GSP42-30	3	30	42x72	34	38	48	115	109	102	102	105	43	4890	192,300	170,000
H300-GSP48-40	3	40	48x72	44	50	63	150	109	102	102	105	43	6240	251,200	230,000

*The flow rate parameters on the chart are suggested starting points.

*For critical applications a pilot study should be performed to validate water quality/production

**Based on 55°F. Temperatures under 55°F or over 60°F may need DLFC adjustments.

***Fe Equivalent – CR – Continuous Regeneration = (1.0 x Fe) + (2.0 Mg) + (0.5 x H2S)

***Fe Equivalent – IR – Intermittent Regeneration = (1.0 x Fe) (2.0 x Mg) + (5.0 x H2S)

¹All dimensions are ± 1"

²Allow additional 12" for media loading

³Available in top-mount or side-mount

- Service and backwash flow rates are based on 55°F incoming water temperature.
- Pressure range: 40-100 PSI
- Temperature range: 40-100°F
- pH range: 6.2-8.5, Ideal is 6.5 or greater

These systems require Chlorine or Potassium Permanganate for regeneration. Regenerate may be fed in proportionally for continuous regeneration or intermittently during backwashing/rinsing regeneration

Operating Parameters - As a general rule, lower flow rates produce higher quality water and large volume of treated water between backwashing. The application parameters on this sheet are suggestions. For critical applications a pilot study should be performed to validate water quality/production.

Superior

- High Contaminate Levels
- Quality-Critical Applications
- Low Pressure Loss

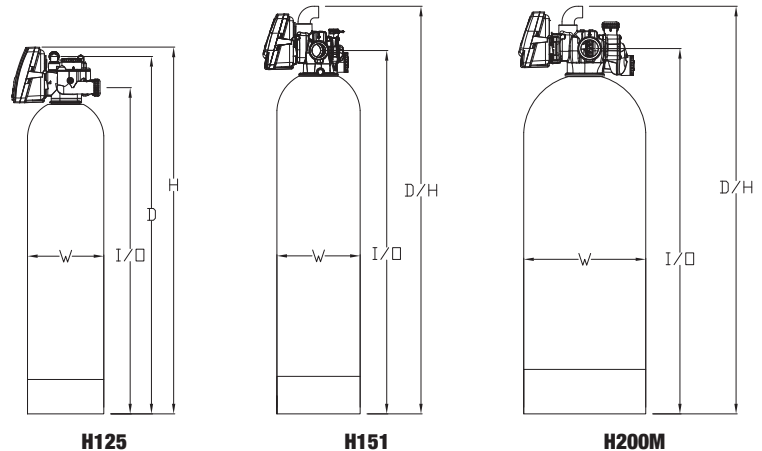
High

- Medium Contaminate Levels
- Non-Critical Applications

Utility

- Low Contaminate Levels
- Non-Critical Applications
- High Pressure Loss

Media: Anthracite, GreensandPlus, Support Bed



Consult Hellenbrand's technical support department for proper sizing, regeneration procedures, additional sizes, modifications or special application assistance.