

Section 5 – Sanitary Sewer

5.01.000 GENERAL

5.01.010 Definition

Sanitary sewerage refers to waste water derived from domestic, commercial and industrial pretreated waste to which storm, surface, and ground water are not intentionally admitted. Pretreatment shall follow all the requirements as set forth by BMC 13.08.340, 13.08.350 & 13.08.360.

See Section 1 for definitions of specific sewers. Maintenance of the building or side sewer and lateral to the main shall be the responsibility of the property owner. Maintenance of the main line shall be the responsibility of the City of Blaine.

5.01.020 Extensions

Any extension of Blaine's sanitary sewer system must be approved by the Department of Public Works and must conform to the City of Blaine Comprehensive Sanitary Sewer Plan, Whatcom County Health Department, Department of Ecology (DOE), and Department of Health (DOH) requirements.

Anyone who wishes to extend or connect to the City's sewer system should contact the Department of Public Works for a sewer extension/connection fee estimate of the costs due the City for a sewer extension or connection.

5.01.030 Availability of sewer

Within the corporate City limits where a public sewer is available it must be used (BMC 13.08.260). Where public sewer is not available within the City limits, connection is required provided that the sewage from the structure originates within 200 feet of the public sewer, except in the case of private residential or commercial developments where the developed property abuts a right-of-way in which a public sewer is located or where a service connection is otherwise provided. In this case, all structures generating sewage shall be required to connect to the public sewer if any part of them is within 500 feet of the public sewer (BMC 13.08.270).

5.01.040 Conditions

Prior to the release of any water meters all Public Works improvements must be completed and approved and all applicable fees must be paid.

5.01.050 Marking Side Sewers

The location of all side sewers shall be marked with a 1¼" white PVC pipe ASTM 2241, SDR 21 200 PSI. It shall be placed vertically at the end of the service stub and rise two feet above the finished grade level. Both ends of the pipe shall have caps glued on and the interior shall be kept clean for the purpose of future depth measurement.

5.01.060 Sanitary Sewer/Water Main Crossings

See Section 4 for requirements regarding sewer and water separation.

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5.01.070 Staking

- ALL surveying and staking shall be performed by an engineering or surveying firm capable of performing such work. The engineer or surveyor directing such work shall be licensed as a Professional Engineer or Professional Land Surveyor by the State of Washington.
- A preconstruction meeting shall be held with the City prior to commencing staking. All construction staking shall be inspected by the City prior to construction.
- The minimum staking of sewer lines shall be as directed by the City Engineer or as follows:

Mainline

Stake location of mainline pipe and laterals every 50 feet with cut or fill to invert of pipe.

Manholes

Stake location of all manholes for alignment and grade with cut or fill to rim and invert of pipes.

5.01.080 Trench Excavation

See Section 4 for requirements regarding trench excavation.

5.01.090 Backfilling

See Section 4 for requirements regarding backfilling.

5.01.100 Street Patching and Restoration

See Section 2 for requirements regarding street patching and trench restoration.

5.02.000 GRAVITY SEWER

5.02.010 General

All sewers shall be designed as a gravity sewer whenever physically and/or economically feasible or as outlined in the Comprehensive Sanitary Sewer Plan.

5.02.020 Design Standards

- The design of any sewer extension/connection shall conform to City Standards, Department of Ecology's "Criteria of Sewage Works Design"(commonly referred to as the "Orange Book"), and any applicable standards as set forth herein and in Section 1.
- The layout of extensions shall provide for the future continuation of the existing system as determined by the City. (BMC 13.08.511) See Section 1 for utility extension information.
- New gravity sewer systems shall be designed on the basis of an average daily per capita flow of sewage of not less than 100 gallons per day. See the appropriate DOE table on Design Basis for Sewage. This figure is assumed to cover normal infiltration, but an additional allowance shall be made where

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conditions are unfavorable. Generally, laterals and submain sewers should be designed to carry, when running full, not less than 400 gallons daily per capita contributions of sewage. When deviations from the foregoing per capita rates are used, a description of the procedure used for sewer design shall be submitted to the Department of Public Works for review and approval.

- The General Notes on Standard Plan 5-1 and 5-2 shall be included on any plans dealing with sanitary sewer design.

5.02.030 Main Line - Gravity

Size

- Sewer mains shall be sized for the ultimate development of the tributary area. Nothing shall preclude the City from requiring the installation of a larger sized main if the City determines a larger size is needed to meet the requirements for future service.(BMC 13.08.500)
- The minimum size for submains and mains shall be 8 inch inside diameter. The minimum size for a lateral shall be 6 inches. See definitions in Section 1.
- A 6 inch diameter main may be approved if it meets all of the following criteria as outlined in Section 2.311 of the Department of Ecology's "Criteria for Sewage Works Design".
- The design is subject to all other design requirements as noted in this Section.

Material

Sewer main shall be PVC, ASTM D 3034, SDR 35 or ASTM F 789 with joints and rubber gaskets conforming to ASTM D 3212 and ASTM F 477, unless special depths or foundation conditions warrant a heavier class or type of pipe.

Depth

Gravity sewer will typically have a minimum depth of 5 feet to provide gravity service to adjoining parcels, adequate head room within manholes for maintenance personnel and vertical clearance between water and sewer lines. Actual depth will be determined by slope, flow, velocity and elevation of existing system.

Connections to the Main

All building sewer connections to the main shall be made with a tee connection. All new mains connecting to existing mains shall require the installation of a new manhole if not made at an existing manhole.

Increasing Size

Manholes shall be provided where pipe size changes occur.

Where a smaller sewer joins a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient. An alternate

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method for securing these results is to place the 0.8 depth point of both sewers at the same elevation.

Slope

All sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than 2.0 feet per second based on Mannings formula using an "n" value of 0.013. Use of other practical "n" values may be permitted by the City if deemed justifiable on the basis of research or field data submitted. The following minimum slopes should be provided; however, slopes greater than these are desirable.

Sewer Size (Inches)	Minimum %	% Slope (Feet per 100')
6	1.00	(0.0100 Ft/Ft)
8	0.40	(0.0040 Ft/Ft)
10	0.28	(0.0028 Ft/Ft)
12	0.22	(0.0022 Ft/Ft)
14	0.17	(0.0017 Ft/Ft)
15	0.15	(0.0015 Ft/ Ft)
16	0.14	(0.0014 Ft/Ft)
18	0.12	(0.0012 Ft/Ft)
21	0.10	(0.0010 Ft/Ft)
24	0.08	(0.0008 Ft/Ft)
27	0.07	(0.0007 Ft/Ft)
30	0.06	(0.0006 Ft/Ft)
36	0.05	(0.0005 Ft/Ft)

Special Conditions

Under special conditions, slopes slightly less than those required for the 2.0 feet per second velocity may be permitted by the City Engineer. Such decreased slopes will only be considered where the depth of flow will be 0.3 of the diameter or greater for design average flow. Whenever such decreased slopes are proposed, the design engineer shall furnish with the plans his computations of the depths of flow in such pipes at minimum, average, and daily or hourly rates of flow. Larger pipe size shall not be allowed to achieve lesser slopes.

Uniform Slope

Sewers shall be laid with uniform slope between manholes.

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High Velocity Protection

Where velocities greater than 15 feet per second are expected, special provisions such as thrust blocking and piping materials shall be made to protect against displacement by erosion and shock.

5.02.040 Connection to Existing System

Connection to Existing System

At connection to Existing system, all new sewer connections shall be physically plugged until all tests have been completed and the City approves the removal of the plug.

Connection to Existing Manholes

Connection of new pipe lines to existing manholes shall be accomplished by using provided knock-outs. Where knock-outs are not available, the manhole shall be core drilled for connection. The transition of connecting channels shall be constructed so as not to interrupt existing flow patterns.

No Manhole Available

Connection of a pipe line to a system where a manhole is not available shall be accomplished by pouring a concrete base and setting manhole sections. The existing pipe shall not be cut into until approval is received from the city.

Drop Manholes

Connections to manholes requiring a drop shall follow the criteria as outlined in Section 5 "Drops". All drop connections require the approval of the Public Works Director.

New Manhole Required

Connections where a new building sewer is the same size as the existing main and where an existing stub out is not available shall be accomplished by the installation of a new manhole.

Taps

Taps shall not be allowed to protrude into the existing main. A City inspector shall be notified 48 hours prior to any tap of a City sewer. A City Inspector shall be present to witness the tap.

5.02.050 Manholes

Precast Manholes

Precast manholes shall meet the requirements of ASTM C 478 with either a precast base or a cast-in-place base made from 3000 psi structural concrete. Manholes shall be Type 1, 48 inch diameter minimum. The minimum clear opening in the manhole frame shall be 24 inches. Joints shall be rubber gasketed conforming to ASTM C 443 and shall be grouted from the inside. Lift holes shall be grouted from the outside and inside of the manhole. Manholes

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constructed of other materials may be approved by the Director of Public Works, provided they meet the requirements of 2.318 of Department of Ecology's "Criteria for Sewage Works Design". Material specifications need to be submitted for review before an alternate material will be considered. See drawing numbers 5 -1 and 5 -2 for details.

Eccentric Manhole

Eccentric manhole cone shall be offset so as not to be located in the tire track of a traveled lane. The manhole rungs shall be directly in line with the offset of the cone to provide access.

Manhole Frames and Covers

Manhole frames and covers shall be cast iron casting marked "Sewer" conforming to the requirements of ASTM A-30, Class 25, and shall be free of porosity, shrink cavities, cold shuts or cracks, or any surface defects which would impair serviceability. Repairs of defects by welding or by the use of smooth-on or similar material will not be permitted. Manhole rings and covers shall be machine-finished or ground-on seating surfaces so as to assure non-rocking fit in any position and interchangeability. Manholes located in areas subject to inflow shall be equipped with a PRECO sewer guard watertight manhole insert or approved equal. All casting shall be coated with a bituminous coating prior to delivery to the job site.

Lock-Type Castings

Where lock-type castings are called for, the casting device shall be such that the cover may be readily released from the ring and all movable parts shall be made of non-corrosive materials and otherwise arranged to avoid possible binding.

Safety Steps

Safety steps shall be fabricated of polypropylene conforming to an ASTM D-4101 specification, injection molded around a 1/2 inch ASTM A-615 grade 60 steel reinforcing bar with anti-slip tread. Steps shall project uniformly from the inside wall of the manhole. Steps shall be installed to form a continuous vertical ladder with rungs equally spaced on 12 inch centers. See WSDOT standard plans for details.

Alignment

Generally, gravity sewers shall be designed with straight alignment between manholes, however, curved alignment may be permitted when conditions warrant.

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Manhole Spacing

Manholes shall be provided at a maximum of 300 foot intervals where 6 inch sewer is allowed, 400 foot intervals for 8 inch to 15 inch sewers, 500 foot intervals for 18 inch to 30 inch sewers, at intersections, and at changes in direction, grade or pipe size. (See also Section 5 "Increasing Size".) Greater spacing may be permitted in larger sewers.

Minimum Slope

Minimum slope through the manhole shall be 1/10th of one foot from invert in to invert out.

Manhole Sizing

Manhole Sizing shall be determined by the following criteria:

48" Manhole

- 2 connecting pipes, 8 inch to 12 inch diameter
- 3 connecting pipes, 8 inch to 10 inch diameter, perpendicular
- 4 connecting pipes, 8 inch diameter, perpendicular

54" Manhole

- 2 connecting pipes, 8 inch to 12 inch with more than 45° deflection
- 3 connecting pipes, 10 inch to 12 inch diameter, perpendicular
- 4 connecting pipes, 10 inch to 12 inch diameter, perpendicular

72" Manhole

- 2 connecting pipes, 15 inch to 18 inch diameter with less than 45° deflection
- 3 connecting pipes, 15 inch diameter, perpendicular
- 4 connecting pipes, 15 inch diameter, perpendicular

Deflection

In the above criteria "deflection" refers to the angle between any 2 pipe channels in the manhole. For other pipe configurations, the size of the manhole shall be approved by the City. The above configurations will provide adequate shelves and room for maintenance and performing TV inspections.

Drops

Straight grades between invert out of last manhole and connection to existing are preferred over drops whenever possible. Care must be taken when designing steep grades or sweeps so as not to create a situation of excessive velocity or excavation. Grade changes associated with "sweeps" shall not be allowed unless otherwise approved by the City Engineer.

An outside drop connection shall be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the

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difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert shall be filleted to prevent solids deposition.

An inside drop connection will not be allowed by the City unless otherwise approved by the Public Works Director.

Outside drop structures shall be constructed per drawing number 5-4.

5.02.060 Cleanouts

Cleanouts are not an acceptable substitute for manholes, however, they may be used in lieu of manholes at the end of 6 or 8 inch diameter lines of not more than 150 feet in length. This does not include a 6 Inch building sewer to serve one or two single family dwellings. Location of cleanout for building sewer is governed by the Uniform Plumbing Code.

All cleanouts in City right-of-way shall be extended to grade and a 3 foot square by 4 inch concrete pad shall be installed around all cleanouts that are not in a pavement area. See detail 5-5.

5.02.070 Building Sewer

A building or side sewer refers to the extension from a building sewer beginning two feet outside the outer foundation wall at the structure to the sanitary sewer main. Building sewers from the main to the right-of-way line shall be minimum 4-inch diameter. Maintenance of the building sewer is the responsibility of the property owner (BMC 13.08.515). Prior to connection of a building sewer to the public sewer a connection permit must be obtained from the City (BMC 13.08.400). Materials and design criteria for a building sewer are covered by the Uniform Plumbing Code (UPC)(BMC 13.08.450). Inspection of the building sewer is the responsibility of the Community and Economic Development Department.

5.02.080 Testing Gravity Sewer

Prior to acceptance and approval of construction, the following tests shall apply to each type of construction.

Low Pressure Air Test

- Prior to acceptance of the project, the gravity sewer pipe shall be cleaned and subject to a low pressure air test per WSDOT/APWA Standards. The contractor shall furnish all equipment and personnel for conducting the cleaning and testing under the observation of the City inspector. The testing equipment shall be subject to the approval of the City.
- The contractor shall make an air test for his own purposes prior to notifying the City to witness the test. The acceptance air test shall be made after trench is backfilled and compacted and the roadway section is completed to subgrade.
- Wyes, Tees & Service Stubs. All wyes, tees, and end of side sewer stubs shall be plugged with flexible joint caps, or acceptable alternates, securely fastened to withstand the internal test pressures. Such plugs or caps shall be

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readily removable and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension.

Cleaning

Prior to pipe testing, all pipes shall be cleaned in the following manner:

- The Contractor shall furnish an inflatable rubber ball of a size that will inflate to fit snugly into the pipe to be tested. The ball may, at the option of the Contractor, be used without a tag line; or a rope or cord may be fastened to the ball to enable the Contractor to know and control its position at all times. The ball shall be placed in the last cleanout or manhole on the pipe to be cleaned and water shall be introduced behind it. The ball shall pass through the pipe with only the force of the water impelling it. All debris flushed out ahead of the ball shall be removed at the first manhole where its presence is noted. In the event cemented or wedged debris or damaged pipe stops the ball, the Contractor shall remove the obstruction.

An option to the above method is the use of a high pressure water jet machine designed to clean sanitary sewer mains.

Video Inspection

Testing of the sewer main shall include a video inspection by the contractor for all sewer main extensions greater than on stick of pipe. Video inspection may be done after the air test has passed and before the roadway is paved.

Immediately prior to a video inspection, enough water shall be run down the line so it comes out the lower manhole. A copy of the video tape and written report shall be submitted to the City. Acceptance of the line will be made after the tape has been reviewed and approved by the Inspector. Any tap to an existing system needs to be televised as well.

The golf ball water level standard shall be used to determine failure for sewer pipe sag. In short, during video inspection, a golf ball is pulled on the return trips and when the golf ball goes under water, that section of sewer pipe will need to be reconstructed. The sewer shall be charged with water prior to this test being run.

Manhole Water Test

A water test of all manholes may be required. The water test shall be made by the contractor first by filling the manhole up with water and letting it sit for 24 hours to allow the water to saturate the concrete. After 24 hours the manhole shall be filled to the top of the cone. The water cannot drop more than 0.05 gallons in 15 minutes per foot of head above invert to pass. Upon completion of the water test, the water shall be pumped out of the manhole and not allowed to be released to the system.

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Mandrel Test

A mandrel test in accordance with Section 717.3(4)H of the Standard Specifications may be required on all sewers except laterals as defined in Section 1 of these standards.

5.03.000 LIFT STATIONS

5.03.010 General

All lift stations will be designed to serve the appropriate basin as identified in the Blaine "Comprehensive Sanitary Sewer Plan".

5.03.020 Design Standards

The design of any lift station shall conform to City standards, Department of Ecology's "Criteria of Sewage Works Design" and applicable standards as set forth herein and in Section 1. In addition, the plans shall include the following:

- An overall site drawing of the lift station showing the location of all components including elevations;
- Service size, voltage and enclosure type and location in relation to the pump station;
- A list of specific materials used including quantity description and manufacturer name;
- A schematic and line diagram of the service and motor control center and lift station;
- The electrical shall be designed to meet state and local electrical code requirements;
- The plans shall show all applicable telemetry installation with schematics; and
- Three copies of an operation and maintenance manual from the lift station manufacturer shall be supplied.
- A lift station emergency by-pass connection shall be installed per drawing number 5 -20.
- A design report shall be submitted with each lift station demonstration its conformance with the standards as outlined above and shall address the following items:

Pump Data:	Size and type
	Horse power rating
	Pump curves
	Head capacity
	Velocity
Motor Data:	Size and type
	Type of frame mount
Controls:	Type
	Cycle length

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Telemetry:	Alarm system
Housing:	Size and type Ventilation and humidity control Interior lighting Access

Auxiliary Power Provision for connection required of all lift stations and may be required to furnish Auxiliary generator at the direction of the City.

Well Sizing	Type Storage capacity
Maintenance	Warranty Tools and equipment required
Electrical Service	Size and type Source
Corrosion Protection	Type of materials Coatings Linings Maintenance
Site Layout	Location of lift station on property
Testing	Operational Pressure
Piping and Valves	Size and type Bypass

See Section 5, Pressure Sewer for additional information regarding force mains.

5.04.000 PRESSURE SEWER (FORCE MAIN)

5.04.010 General

Low pressure systems, i.e., force mains may be considered for situations where high ground water table or topography make gravity sewer impractical.

5.04.020 Design Standards

The design of any sewer extension/connection shall conform to City standards, Department of Ecology's "Criteria of Sewage Works Design", and any applicable standards as set forth herein and Section 1.

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The layout of extensions shall provide for the future continuation of the existing system as determined by the City. In addition, main extensions shall be extended to and through the side of the affected property fronting the main.

The system shall be designed at full depth of flow on the basis of an average daily per capita flow per DOE's criteria. A friction factor of 0.013 shall be used for Mannings "n" value.

New sewer systems shall be designed by methods in conjunction with the basis of per capita flow rates. Methods shall include the use of peaking factors for the contributing area, allowances for future commercial and industrial areas, and modification of per capita flow rates based on specific data. Documentation of the alternative method used shall be provided along with plans.

The applicable General Notes in Section 5 shall be included on any plans dealing with pressure sanitary sewer design.

5.04.030 Force Main

Material

Force mains for sizes up to 12 inches shall be ductile iron AWWA C151 Class 50 or PVC C900 with ductile iron fittings and gasketed joints. For 14 to 24 inch mains, pipe shall be ductile iron AWWA C151 Class. A more rigid pipe may be required where unlimited trench widths occur. All ductile iron pipe and fittings shall be epoxy coated or PE lined and designed for use with corrosive materials.

Alternatively, polyethylene pipe may be used, at the discretion of the Public Works Director.

Depth

Force mains shall have a minimum 36 inches of cover to top of pipe. See Section 4 for sanitary sewer/water main crossing requirements.

5.04.040 Velocity

The minimum velocity allowed is 2 feet per second (fps) at average Dry Weather Flow. 2 fps is required to maintain solids in suspension although 3 fps is desired to scour settled solids. Maximum velocity allowed shall be 8 fps.

5.04.050 Surge Protection

PVC is subject to fatigue failure due to cyclic surge pressures. This shall be constructed to minimize rapid changes in velocities and a properly sized surge tank.

5.04.060 Air/Vacuum Valves

Air release valves and air/vacuum valves shall be located at the high points of the line within a standard 48 inch manhole or a comparable sized, approved vault. Air release valves shall be fitted with an activated carbon canister to absorb compounds with disagreeable odors prior to releasing the air to the

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surrounding area. Grades shall be designed to minimize the need for air/vacuum valves when practical. Vehicular access to valve is required for maintenance.

5.04.070 Force Main Drain

Provisions to drain a force main to facilitate repairs or to temporarily remove force main from service shall be provided. This may be accomplished through the use of a valved tee connected to a drain line at the low point of the line. A manhole shall be set over the force main at the valved tee.

5.04.080 Thrust Blocking

Location of thrust blocking shall be shown on plans. Thrust block concrete shall be Class B poured against undisturbed earth. A plastic barrier shall be placed between all thrust blocks and fittings.

See standard detail number 6-14 and 6-15 in water section. Designed and approved restraining joint systems may be allowed in lieu of thrust blocking. Restraining joint brand, type, and size shall be specified on the plans.

5.04.090 Force Main Termination

Hydrogen sulfide odors (H₂S) and the buildup of sulfuric acid (H₂SO₄) occur in the operation of a force main. To mitigate these conditions some type of control method(s) shall be used. This may include chemical addition at the pump station and/or the reaeration of the waste water at or near the terminus. Reaeration may include the following:

- Construction of a vault housing an aspiration assembly.
- The use of hydraulic fall (vertical siphon) within the terminal manhole.
- High velocity discharge with smooth transition so as to not cause splashing of force main into the down stream gravity sewer.
- These methods would all require an adequate source of fresh air at the vault or manhole. At a minimum, the manhole at the terminus and the first manhole downstream of the terminus shall be coated with Tnemec 120 vinyl ester, Quantum polymorphic resin or approved equal which is resistant to sulfuric acid and hydrogen sulfide.

5.04.100 Check Valves

Check Valves are required to prevent backflow of force main into wet well as pumps cycle. They shall be located in a separate vault adjacent to the wet well.

5.04.110 Testing Force Main

Main line

- Prior to acceptance of the project, the pressure line and service lines shall be subjected to a hydrostatic pressure test of 200 pounds for 4 hours and any leaks or imperfections developing under said pressure shall be remedied by the contractor. No air will be allowed in the line. The main shall be tested between valves. Insofar as possible, no hydrostatic pressure shall be placed

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against the opposite side of the valve being tested. The pressure test shall be maintained while the entire installation is inspected.

- The contractor shall provide all necessary equipment and shall perform all work connected with the tests. Tests shall be made after all connections have been made. This is to include any and all connections as shown on the plan. The contractor shall perform all tests to assure that the equipment to be used for the test is adequate and in good operating condition and the air in the line has been released before requesting the City to witness the test.

Wet Wells

- A water test for all wet wells in accordance with the manhole water test for gravity sewer may be required.
- A mandrill test in accordance with Section 5 -17.3(4)H of the Standard Specifications may be required.
- Pump operation, alarms, and electrical inspection of all lift stations is required.

LIST OF DRAWINGS

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