Information Document

Northwest Area Transmission Constraint Management

ID # 2011-004(R)

Information documents are for information purposes only and are intended to provide guidance. In the event of any discrepancy between the information document and the related authoritative document(s) in effect, the authoritative document(s) governs.

1 Purpose

This information document supports new ISO rules 302.4, *Northwest Area Transmission Constraint Management,* and provides additional information regarding the unique operating characteristics and resulting constraint conditions and limits in the northwest area of the interconnected electric system.

2 Related Authoritative Documents

The AESO's authoritative documents consist of ISO rules, the ISO tariff and the reliability standards. Authoritative documents contain binding rights, requirements and obligations for market participants and the AESO. Market participants and the AESO are required to comply with provisions set out in authoritative documents.

The AESO encourages market participants to review the related authoritative documents which include:

(1) Section 302.4 of the ISO rules, *Northwest Area Transmission Constraint Management*

This section of the ISO rules define the northwest area, describe cutplanes in the identified regions, identify the effective assets used to manage a transmission constraint, and sets out the transmission constraint management protocol steps for the area.

(2) Section 302.1 of the ISO rules, Real *Time Transmission Constraint Management*

This section of the ISO rules sets out the general constraint management protocol steps the AESO uses to manage constraints in real time on the interconnected electric system. These steps are referenced in Table 1 of section 302.4 as they are applied to the northwest area.

4 General

The interconnected electric system in the northwest area consists of long 144 kV and 240 kV bulk transmission lines, generally with a low degree of redundancy of transmission paths. The northwest area total generating capacity is substantially less than the area load, leading to inflows of energy under normal operation. Some of the 144 kV bulk transmission lines are heavily loaded.

The outage of a single bulk transmission line or a generating unit may result in voltage depressions outside of the acceptable system operating limits in accordance with *Alberta Reliability Standard TPL-002-AB-0 – System Performance Following the Loss of a Single BES Element*. The AESO can partially mitigate this risk by ensuring a sufficient minimum amount of transmission must-run generating unit capacity is available under contract with the AESO. The availability of transmission must-run services reduces the risk of losing firm load due to low voltages, and a voltage collapse for certain critical transmission or generation contingencies. There is also interruptible load in the Grande Prairie region that the AESO can curtail by directive when required to maintain system reliability.

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Two maps of the northwest area are provided in Appendix 1 to this Information Document. Figure 1 provides a detailed geographical map of the northwest area indicating bulk transmission lines, substations and cut planes. Figure 2 provides a detailed view of the northwest area cutplanes including the generating units effective in managing a regional transmission constraint.

5 Constraint Conditions and Limits

Cut Plane Inflow Limits

There are two (2) cut planes in the northwest area regions; one for the Grande Prairie region and one specific to the Rainbow Lake region. Both of these cut planes are reflected on the map in Appendix 1. As mentioned above, the area generation capacity is substantially less than the area load, which leads to inflows of energy into the area under normal circumstances. The specific contingency conditions and inflow limits are set out in Appendix 2 of this Information Document.

Generation Capacity Limits

Due to angular stability and voltage concerns in the Grande Prairie region, there is a need to limit generation capacity of the pool assets PH1 (Poplar Hill generating unit) and NPP1 (Grand Prairie Generation Inc. generating unit). Please refer to Appendix 5 of this Information Document to review the specific conditions and limits.

Operating Modes and Limits

If the Poplar Hill or Valleyview # 1 generating units are operating in either synchronous condenser mode or MW generation mode, the AESO will increase the Grande Prairie cut plane inflow limits by the amount specified in Appendix 3 of this Information Document. The increases contemplated in Appendix 3 are only applicable when there is a net power transfer-out as measured at the Ruth Lake and Leismer cut planes in the northeast area under N-0 and N-HRM conditions.

Due to the long transmission paths and the resulting lack of voltage support, there is a need to establish minimum generation requirements for Rainbow Lake region. These conditions and minimum generation requirements are set out in Appendix 4.

6 Transmission Constraint Management

The AESO manages transmission constraints in the northwest area in accordance with the protocol steps set out in section 302.4 of the ISO rules, *Northwest Area Transmission Constraint Management* which are representative of the protocol steps the AESO uses to manage transmission constraints in real time and as set out in section 302.1 of the ISO rules, *Real Time Transmission Constraint Management*

While the AESO follows the section 302.1 protocol steps it uses to manage constraints in real time, not all of those steps may be effective in managing constraints due to unique operating conditions in the northwest area. And, because of the unique operating conditions, the AESO may need to use additional steps to effectively manage constraints in the northwest area.

The protocol steps which are effective in managing transmission constraints are described below as well as any additional steps required.

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Applicable Protocol Steps

The first step in managing a transmission constraint in any area is to identify those generating units effective in mitigating the transmission constraint. A list of the generating units effective in managing the transmission constraint is set out in Appendix 1 of section 302.4.All of the remaining section 302.1 protocol steps the AESO uses to manage a transmission constraint in real time are applicable for the northwest area with the exception of curtailing effective demand opportunity service on the downstream constraint side, and curtailing effective generating units in reverse energy market merit order followed by pro-rata curtailment.

Curtailing effective demand opportunity service on the downstream constraint side is not effective because there is no demand opportunity service load in the area to curtail.

Curtailing effective generating units in reverse energy market merit order followed by pro-rata curtailment is not effective because the constraint is caused by not having enough in-merit generation in the downstream constrained area.

Due to the operating characteristics of the northwest area, the AESO may also use the additional steps listed in subsection 3(3) of section 302.4.

8 Appendices to this Information Document

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Appendix 1 – Northwest Area Maps (— · · — indicates the cut planes)

Figure 1 – Geographical Map of the Northwest Area

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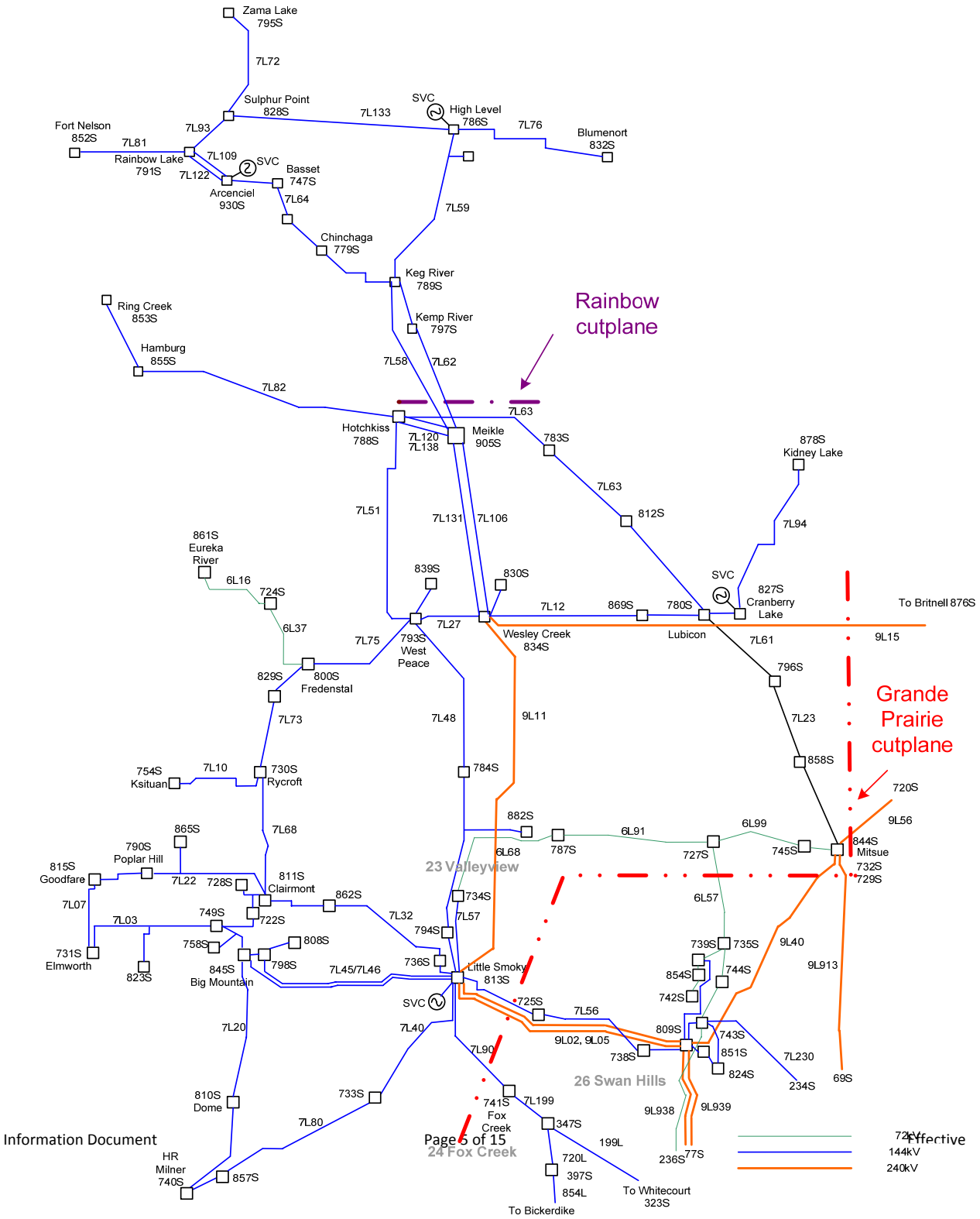

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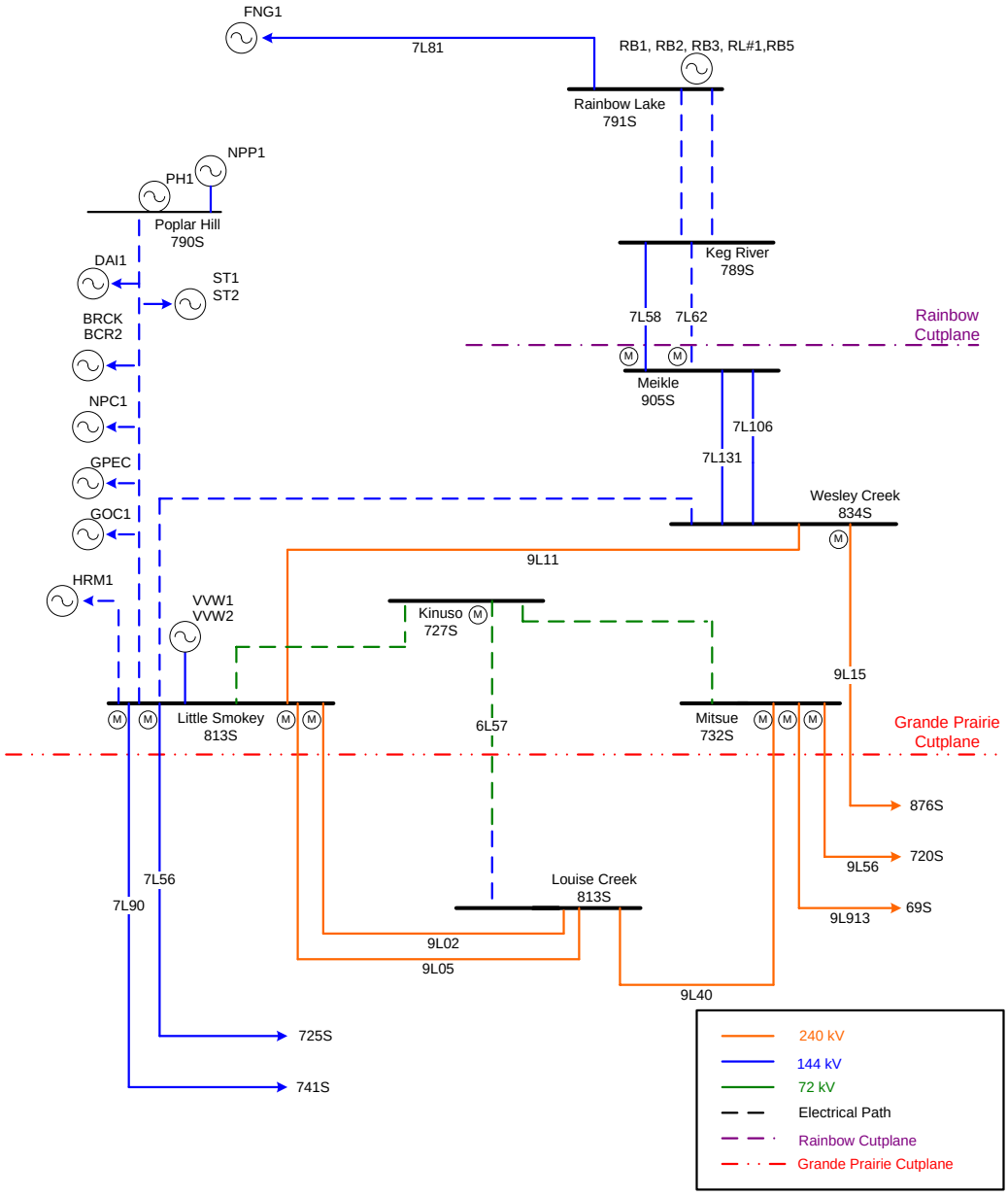
Figure 2 – Northwest Area Cutplanes



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Appendix 2 – Grande Prairie Cut Plane Inflow Limits

Table 1

Grande Prairie Cut Plane Limit for a Northeast Area Export			
Contingency Conditions	Maximum Grande Prairie region load studied 860 MW		
	HR Milner = 70 MW	70 MW < HR Milner < 140 MW X = HR Milner generation – 70 MW	HR Milner = 140 MW
No contingencies	585 + SCM[1] effect (Appendix 3)	585 – (0.71 * X)	535
GPEC or BCR2 steam	590	590 – (0.79 * X)	535
9L11	610	610 – (0.93 * X)	545
9L15	585	585 – (0.57 * X)	545
9L02 or 9L05	485	485	485
919L or 989L	470	470 – (0.21 * X)	455
9L938 or 9L939	485	485	485
9L40	570	570 – (0.93 * X)	505
9L56	600	600 – (0.79 * X)	545
9L913	545	545 – (0.79 * X)	490
7L56	600	600 – (0.57 * X)	560
7L90	600	600 – (0.57 * X)	560
7L23	575	575 – (0.71 * X)	525
7L61	595	595 – (0.57 * X)	555
6L57	610	610 - (0.79 * X)	555
HR Milner < 70 MW	590 + SCM effect (Appendix 4)	590	590
Little Smoky SVC	565	565 – (1.29 * X)	475
Cranberry SVC	595	595 – (1 * X)	525

[1] SCM means synchronous condenser mode.

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Examples to assist with interpretation of Table 1:

1. If HR Milner is generating at 70 MW and transmission line 9L15 is out of service then the export limit is 585 MW.
2. If HR Milner is generating at 100 MW and the region load is less than 860 MW, and transmission line 9L15 out of service then the export limit is calculated as 585 – (0.57*(100 – 70)) = 567.9 MW.
3. If HR Milner is generating at 140 MW and transmission line 9L15 is out of service then the export limit is 545.

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Table 2

Grande Prairie Cut Plane Limit for a Northeast Area Import			
Contingency Conditions	Maximum Grande Prairie region load studied 860 MW		
	HR Milner = 70 MW	70 MW < HR Milner < 140 MW X = HR Milner generation – 70 MW	HR Milner = 140 MW
No contingencies	565	565 – (0.36 * X)	540
GPEC or BCR2 steam	555	555 – (0.21 * X)	540
9L11	590	590 – (0.64 * X)	545
9L15	545	545	545
9L02 or 9L05	440	440	440
919L or 989L	405	405	405
9L938 or 9L939	460	460	460
9L40	530	530 – (0.71 * X)	480
9L56	575	575 – (0.29 * X)	555
9L913	550	550 – (1.43 * X)	450
7L56	570	570	570
7L90	570	570	570
7L23	550	550 – (0.36 * X0	525
7L61	560	560	560
6L57	580	580 – (0.29 * X)	560
HR Milner < 70 MW	560	560	560
Little Smoky SVC	540	540 – (1.14 * X)	460
Cranberry SVC	570	570 – (0.86 * X)	510

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Examples to assist with interpretation of the Table 2:

1. If HR Milner is generating at 70 MW and transmission line 9L11 is out of service then the import limit is 590 MW.
2. If HR Milner is generating at 100 MW and the region load is less than 860 MW, and transmission line 9L11 out of service then the export limit is calculated as 590 – (0.64*(100 – 70)) = 570.8 MW.
3. If HR Milner is generating at 140 MW and transmission line 9L11 is out of service then the export limit is 545.

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Appendix 3 – Operating Mode and Grande Prairie Cut Plane Inflow Limits

Table 3 below sets out the inflow limits if the Poplar Hill or VW1 generating units are operating in either synchronous condenser mode or MW generation mode:

Table 3

Increase to Grande Prairie Cutplane Transfer-in Limit			
System Conditions	PH1 in SCM or generating MW	VVW1 in SCM or generating MW	Both PH1 and VVW1 in SCM or generating MW
System normal	+30	+20	+45
HR Milner contingency	+10	+0	+20

Examples to assist with interpretation of Table 3:

1. For any limit calculated in Appendix 2 and when VVW1 is in SCM mode or is generating MW, for system normal conditions, the limit calculated from Appendix 2 is increased by 20 MW.

2. For any limit calculated in Appendix 2, if PH1 is generating at some level or in SCM mode, and HR Milner is out of service, the cut plane limit is increased by 10 MW.

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Appendix 4 – Minimum Generation Requirements for the Rainbow Region

Table 4 below sets out the minimum generation requirements for the Rainbow region:

Table 4

Rainbow Region Minimum Generation Requirements

Rainbow Region Load (MW)	Minimum Number of Rainbow Region Generators[3] Providing MW	Minimum generation from Rainbow Region Generators[3] (MW)
Below 81	3	65
81 - 90	3	75
91 - 100	3	90
101 - 110	3	95
111 - 120	3	110
121 - 130	3	120
131 - 140	4	130
141 - 150	4	150
151 - 160	4	160
161 – 170	4	170

An example to assist with interpretation of Table 3e:

If the Rainbow region load is 147 MW, then four (4) generating units in the Rainbow region are required to be on line and producing a minimum of 150 MW. Please refer to Section 6 above for a list of generating units effective in meeting these requirements.

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Appendix 5 – Generation Capacity Limits – Poplar Hill and Grand Prairie

Tables 5 and 6 below set out the generation limits for Popular Hill and Grand Prairie generating units under certain conditions. When reading the tables:

(1) HRM refers to the HR Milner generating unit.
(2) NPP1 refers to the Grand Prairie Generation Inc. generating unit.
(3) PH1 refers to the Poplar Hill generating unit.
(4) Generation Limit refers to the sum of the MW generation plus any operating reserves for which the ISO issued a dispatch.

Table 5

Poplar Hill Unit Generation Capacity Limits

Conditions				Limits (MW)
HRM Status – on line; and – generating 70 MW or more	HRM Status – off line; or – generating less than 70 MW	NPP1 – on line[1]	NPP1 – off line – no dispatches issued for operating reserves	PH1 Generation Limit
Yes	No	Yes	No	42
		No	Yes	48
No	Yes	Yes	No	41
		No	Yes	48

Notes:

[1] NPP1 generating units is considered on line when the sum of MW generation and operating reserves for which the ISO has issued a dispatch is greater than one (1) MW.

An example to assist with interpretation of the table directly above:

If the HRM generating unit is on line and generating seventy (70) MW or more; and the NPP1 generating unit is on line; then the generation limit for the PH1 generating unit is forty two (42) MW.

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Table 6

Grand Prairie Unit Generation Capacity Limits

Conditions					Limits
HRM Status – on line ;and – generating 70 MW or more	HRM Status – off line; or – generating less than 70 MW	PH1 – on line	PH1 off line – no dispatches issued for operating reserves	PH1 – operating in synchronous condenser mode – no dispatches issued for operating reserves	NPP1 Generation Limit (MW)
Yes		Yes[1]			81
Yes			Yes		82
Yes				Yes	93
	Yes	Yes[2]			79
	Yes		Yes		76
	Yes			Yes	93

Notes:

[1]PH1 is online when the sum of MW generation and operating reserves for which the ISO has issued dispatches is greater than 1 MW.

[2]PH1 is online when the MW generation is greater than 1 MW.

An example to assist with interpretation of the Tables:

If the HRM generating unit is on line and generating more than seventy (70) MW or more; and the PH1 generating unit is on line; then the generation limit for the NPP1 generating unit is eighty one (81) MW.

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Revision History

Version	Effective Date	Description of Changes
1.0		Initial Release

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