Prerequisite: Pay Algo to Pool Address from User to cover minimum balance			
Txn: AppCall with Optin from Pool Address to Bootstrap pool & ReKey to Application			
itxn[0]: Pay Algo from Pool to Application			
itxn[1]: Create Pool Token Asset from Application			
itxn[2]: Optin Pool to Asset 1			
itxn[3]: Optin Pool to Asset 2 (if not Algo)			
itxn[4]: Optin Pool to Pool Token Asset			
itxn[5]: Transfer Pool Token total supply to Pool Account			

AppCallTx	AppCall with Optin from Pool Address to Bootstrap pool & ReKey to Application		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	Should not drain the pool's algos beyond the min balance	No	Draining the pool before bootstrapping is irrelevant, and if it results in going below the min balance that will be needed for bootstrapping, the txn will fail.
Sender	The pool contract address generated using the pool's template instantiated with Txn.Assets[0], Txn.Assets[1] and the Approval App ID	Yes	
TxType	AppCall	Yes (implicitly)	
RekeyTo	Approval App Address	Yes	
Application ID	Must be the Approval App ID	Checked against the pool contract source	
OnComplete	OptIn	Yes	
Accounts	[None]	No	
App Arguments	0: "bootstrap"	Yes	
Foreign Apps	[None]	No	
Foreign Assets	0: asset_1_id 1: asset_2_id - The asset IDs must match the ones given in the pool contract	Yes (implicitly)	Inner txns would fail if these ids don't match the pool ids

itxn[0]: PayTx	Pay Algo from Pool to Application		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	0	Yes	
Sender	Pool address, must be the same as the sender of the AppCall	Yes	
TxType	Pay	Yes	
RekeyTo	No rekey	Yes	
Receiver	Approval App Address	Yes	
Amount	100000	Yes	
CloseRemainderTo	No CloseRemainderTo	Yes	

itxn[1]: AssetConfigTx	Create Pool Token Asset from Application		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	0	Yes	
Sender	Approval App Address	Yes	
TxType	Acfg	Yes	
RekeyTo	No rekey	Yes	
~~**ConfigAsset**~~			
AssetParamsTotal	18446744073709551615	Yes	
AssetParamsDecimals	6	Yes	
AssetParamsDefaultFrozen	Not frozen	Yes	
AssetParamsUnitName	TMPOOL2	Yes	
AssetParamsAssetName	TinymanPool2.0 <A1UN>-<A2UN>	Yes	
AssetParamsURL	https://tinyman.org	Yes	
AssetParamsMetaDataHash	<A1ID><A2ID>	Yes	
AssetParamsManagerAddr	None	Yes	
AssetParamsReserveAddr	Pool address, must be the same as the sender of the AppCall	Yes	
AssetParamsFreezeAddr	None	Yes	
AssetParamsClawbackAddr	None	Yes	

itxn[2]: AssetTransferTx	Optin Pool to Asset 1		
Field	**Restrictions**	**Checked?**	**Notes**

Fee		0	Yes	
Sender	Pool address, must be the same as the sender of the AppCall		Yes	
TxType	Axfer		Yes	
RekeyTo	No rekey		Yes	
XferAsset	A1ID		Yes	
AssetAmount		0	Yes	
AssetSender	None		Yes	
AssetReceiver	Pool address, must be the same as the sender of the AppCall		Yes	
AssetCloseTo	None		Yes	

itxn[3]: AssetTransferTx	Optin Pool to Asset 2 (if not Algo)			
Field	**Restrictions**		**Checked?**	**Notes**
Fee		0	Yes	
Sender	Pool address, must be the same as the sender of the AppCall		Yes	
TxType	Axfer		Yes	
RekeyTo	No rekey		Yes	
XferAsset	A2ID		Yes	
AssetAmount		0	Yes	
AssetSender	None		Yes	
AssetReceiver	Pool address, must be the same as the sender of the AppCall		Yes	
AssetCloseTo	None		Yes	

itxn[4]: AssetTransferTx	Optin Pool to Pool Token Asset			
Field	**Restrictions**		**Checked?**	**Notes**
Fee		0	Yes	
Sender	Pool address, must be the same as the sender of the AppCall		Yes	
TxType	Axfer		Yes	
RekeyTo	No rekey		Yes	
XferAsset	PoolAssetID		Yes	

AssetAmount		0	Yes	
AssetSender	None		Yes	
AssetReceiver	Pool address, must be the same as the sender of the AppCall		Yes	
AssetCloseTo	None		Yes	

itxn[5]: AssetTransferTx	Transfer Pool Token total supply to Pool Account			
Field	**Restrictions**		**Checked?**	**Notes**
Fee		0	Yes	
Sender	Approval App Address		Yes	
TxType	Axfer		Yes	
RekeyTo	No rekey		Yes	
XferAsset	PoolAssetID		Yes	
AssetAmount	18446744073709551615		Yes	
AssetSender	None		Yes	
AssetReceiver	Pool address, must be the same as the sender of the AppCall		Yes	
AssetCloseTo	None		Yes	

Txn: AppCall from fee_manager			
AppCallTx	Txn: AppCall from fee_manager (covers the three cases of setting the fee collector, the fee setter and the fee manager)		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	Should not drain the sender's algos beyond the min balance	No	This is up to the sender (manager)
Sender	Must be the Fee Manager	Yes	
TxType	AppCall	Yes	
RekeyTo	None	No	This is up to the sender (manager)
Application ID	Approval App	Yes	
OnComplete	NoOp	Yes	
Accounts	1: new collector/setter/manager account	No	This, in principle, can be any address (even the approval account or a pool account!), but it's assumed that this is a priviledged operation that is carfeully executed.

App Arguments	0: "set_fee_collector"
	   OR
	   "set_fee_setter"
	   OR
	   "set_fee_manager"
		Yes	

Foreign Apps	None	No	
Foreign Assets	None	No	

Txn: AppCall from any user

AppCallTx	Txn: AppCall from any user (covers the two cases of claiming fees and claiming extras)		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	Should not drain the sender's algos beyond the min balance	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	[None]	No	The sender can be any account (but cannot be a bootstrapped pool since they have been rekeyed to the approval program)
TxType	AppCall	Yes	
RekeyTo	[None]	No	This is up to the sender (which cannot be a bootstrapped pool)
Application ID	Approval App	Yes	
OnComplete	NoOp	Yes	
Accounts	1: Pool address => expected to be a valid bootstrapped pool 2: Fee collector address => must be the correct fee collector address stored in the application		

App Arguments	0: "claim_fees"
	    OR
	    "claim_extras"
		Yes	

Foreign Apps	None	No	
Foreign Assets	0: A1_ID 1: A2_ID		

itxn[0]: AssetTransferTx	Transfer fees/extras for asset1		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	0	Yes	
Sender	Pool	Yes	
TxType	Axfer	Yes	
RekeyTo	No rekey	Yes	
XferAsset	A1_ID	Yes	
AssetAmount	Fee/Extra amount (which is non-zero)	Yes	
AssetSender	None	Yes	

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AssetReceiver	Fee Collector Address	Yes	
AssetCloseTo	None	Yes	
itxn[1]: AssetTransferTx	Transfer fees/extras for asset2 (if not Algo)		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	0	Yes	
Sender	Pool	Yes	
TxType	Axfer	Yes	
RekeyTo	No rekey	Yes	
XferAsset	A2_ID	Yes	
AssetAmount	Fee/Extra amount (which is non-zero)	Yes	
AssetSender	None	Yes	
AssetReceiver	Fee Collector Address	Yes	
AssetCloseTo	None	Yes	
OR			
itxn[1]: PayTx	Transfer fees/extras for asset2 if Algo		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	0	Yes	
Sender	Pool	Yes	
TxType	Pay	Yes	
RekeyTo	No rekey	Yes	
Receiver	Fee Collector Address	Yes	
Amount	Fee/Extra amount (which is non-zero)	Yes	
CloseRemainderTo	No CloseRemainderTo	Yes	

AppCallTx	Txn: AppCall from fee_setter		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	Should not drain the sender's algos beyond the min balance	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	Must be the Fee Setter	Yes	
TxType	AppCall	Yes	
RekeyTo	None	No	This is up to the sender (which cannot be a bootstrapped pool)
Application ID	Approval App	Yes	
OnComplete	NoOp	Yes	
Accounts	Pool Address		
App Arguments	0: "set_fee" 1: total_fee_share value 2: protocol_fee_ratio value 1 <= v(1) <= 100 3 <= v(2) <= 10	Yes	
Foreign Apps	None	No	
Foreign Assets	None	No	

Gtxn[N-2]: Transfer Asset1 to Pool from User			
Gtxn[N-1]: Transfer Asset2 to Pool from User			
Gtxn[N]: AppCall from User			
itxn[0]: Transfer Pool Token to User from Pool			

Gtxn[N-2]: AssetTransferTx	Transfer Asset1 to Pool from User		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	None	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	User address, which must be the same as a. the sender of the Gtxn[N-1] txn b. the sender of the Gtxn[N] txn c. the receiver of the itxn[0] txn	(a) Yes (indirectly) (b) Yes (c) Yes	Cannot be a Pool's address by design
TxType	Axfer, must be checked by Gtxn[N]	Yes	
RekeyTo	None	No	
XferAsset	Must be A1_ID of this Pool	Yes	
AssetAmount	Non-zero value	Yes	
AssetSender	None	No	
AssetReceiver	Pool address, which must be equal to a. the receiver of Gtxn[N-1] b. Gtxn[N].Accounts[1] c. the sender of itxn[0]	(a) Yes (indirectly) (b) Yes (c) Yes	
AssetCloseTo	None	No	

Gtxn[N-1]: PayTx	Transfer Asset2 (Algo) to Pool from User		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	None	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	User address, which must be the same as 1. the sender of the Gtxn[N-2] txn 2. the sender of the Gtxn[N] txn 3. the receiver of the itxn[0] txn	(a) Yes (indirectly) (b) Yes (c) Yes	Cannot be a Pool's address by design
TxType	Pay (only if input asset is Algo), must be checked by Gtxn[N], and it must be that A2_ID of this Pool is zero	Yes	
RekeyTo	None	No	

Receiver	Pool address, which must be equal to - the receiver of Gtxn[N-2] - Gtxn[N].Accounts[1] - the sender of itxn[0]	(a) Yes (indirectly) (b) Yes (c) Yes	
Amount	Non-zero value	Yes	
CloseRemainderTo	None	No	
OR			
Gtxn[N-1]: AssetTransferTx	Transfer Asset2 (non-Algo) to Pool from User		

Field	Restrictions	Checked?	Notes
Fee	None	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	User address, which must be the same as 1. the sender of the Gtxn[N-2] txn 2. the sender of the Gtxn[N] txn 3. the receiver of the itxn[0] txn	(a) Yes (indirectly) (b) Yes (c) Yes	Cannot be a Pool's address by design
TxType	Axfer (only if input asset is non-Algo), must be checked by Gtxn[N]	Yes	
RekeyTo	None	No	
XferAsset	Must be A2_ID of this Pool (non-zero)	Yes	
AssetAmount	Non-zero value	Yes	
AssetSender	None	No	
AssetReceiver	Pool address, which must be equal to - the receiver of Gtxn[N-2] - Gtxn[N].Accounts[1] - the sender of itxn[0]	(a) Yes (indirectly) (b) Yes (c) Yes	
AssetCloseTo	None	No	
Gtxn[N]: AppCallTx	AppCall from User		

Field	Restrictions	Checked?	Notes
Fee	None	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	User address, which must be the same as 1. the sender of the Gtxn[N-2] txn 2. the sender of the Gtxn[N-1] txn 3. the receiver of the itxn[0] txn	(a) Yes (b) Yes (c) Yes	Cannot be the pool's address by design
TxType	AppCall	Yes	
RekeyTo	None	No	

Application ID	Approval App ID	Yes	
OnComplete	NoOp	Yes	

Accounts	1: Pool address, which must be
	   a. the address of a valid bootstrapped pool
	   b. the same as the receiver of Gtxn[N-1]
	   c. the same as the receiver of Gtxn[N-2]
	   d. the sender of itxn[0]
		(a) Yes
		(Implicitly)
		(b) Yes
		(c) Yes
		(d) Yes	

App Arguments	0: "add_initial_liquidity"	Yes	
Foreign Apps	None	No	
Foreign Assets	0: pool_token_asset_id The asset ID must be the token asset of the pool contract	Yes (implicitly)	Inner txns would fail if this id doesn't match the pool id

itxn[0]: AssetTransferTx	Transfer Pool Token to User from Pool		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	must be 0	Yes	
Sender	Pool address, which must be equal to - the receiver of Gtxn[N-2] - the receiver of Gtxn[N-1] - Gtxn[N].Accounts[1]	Yes	
TxType	Axfer	Yes	
RekeyTo	No rekey	Yes	
XferAsset	Must be the pool's token asset ID	Yes	
AssetAmount	A non-zero value computed by the logic	Yes	
AssetSender	No AssetSender	Yes	
AssetReceiver	User address, which must be the same as - the sender of the Gtxn[N-2] txn - the sender of the Gtxn[N-1] txn - the sender of the Gtxn[N] txn	Yes	
AssetCloseTo	No AssetCloseTo	Yes	

Other Restrictions			
	Restrictions	**Checked?**	**Notes**
	Pool lock is 0	Yes	
	Pool hasn't yet been initialized (issued pool tokens is 0)	Yes	

Gtxn[N-2]: Transfer Asset1 to Pool from User			
Gtxn[N-1]: Transfer Asset2 to Pool from User			
OR			
Gtxn[N-1]: Transfer Asset1 or Asset2 to Pool from User			
Gtxn[N]: AppCall from User			
itxn[0]: Transfer Pool Token to User from Pool			

Gtxn[N-2]: AssetTransferTx	Transfer Asset1 to Pool from User		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	None	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	User address, which must be the same as 1. the sender of the Gtxn[N-1] txn 2. the sender of the Gtxn[N] txn 3. the receiver of the itxn[0] txn	(a) Yes (indirectly) (b) Yes (c) Yes	Cannot be a Pool's address by design
TxType	Axfer, must be checked by Gtxn[N]	Yes	
RekeyTo	None	No	
XferAsset	Must be A1_ID of this Pool	Yes	
AssetAmount	None (could be zero)	No	Would be best to reject the txn if this is zero
AssetSender	None	No	
AssetReceiver	Pool address, which must be equal to a. the receiver of Gtxn[N-1] b. Gtxn[N].Accounts[1] c. the sender of itxn[0]	(a) Yes (indirectly) (b) Yes (c) Yes	
AssetCloseTo	None	No	

Gtxn[N-1]: PayTx	Transfer Asset2 (Algo) to Pool from User (OR Transfer Asset1 or Asset2 to Pool from User)		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	None	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	User address, which must be the same as a. the sender of the Gtxn[N-2] txn (if applicable) b. the sender of the Gtxn[N] txn c. the receiver of the itxn[0] txn	(a) Yes (indirectly) (b) Yes (c) Yes	

TxType	Pay (only if input asset is Algo), must be checked by Gtxn [N], and it must be that A2_ID of this Pool is zero	Yes	
RekeyTo	None	No	
Receiver	Pool address, which must be equal to a. the receiver of Gtxn[N-2] (if applicable) b. Gtxn[N].Accounts[1] c. the sender of itxn[0]	(a) Yes (indirectly) (b) Yes (c) Yes	
Amount	None (could be zero)	No	Would be best to reject the txn if this is zero
CloseRemainderTo	None	No	
OR			
Gtxn[N-1]: AssetTransferTx	Transfer Asset2 (non-Algo) to Pool from User		

Field	Restrictions	Checked?	Notes
Fee	None	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	User address, which must be the same as 1. the sender of the Gtxn[N-2] txn (if applicable) 2. the sender of the Gtxn[N] txn 3. the receiver of the itxn[0] txn	(a) Yes (indirectly) (b) Yes (c) Yes	Cannot be a Pool's address by design
TxType	Axfer (only if input asset is non-Algo), must be checked by Gtxn[N]	Yes	
RekeyTo	None	No	
XferAsset	If two input txns, this must be A2_ID of this Pool (non-zero) otherwise, this can either be A1_ID or A2_ID of the pool	Yes	
AssetAmount	None (could be zero)	No	Would be best to reject the txn if this is zero
AssetSender	None	No	
AssetReceiver	Pool address, which must be equal to a. the receiver of Gtxn[N-2] (if applicable) b. Gtxn[N].Accounts[1] c. the sender of itxn[0]	(a) Yes (indirectly) (b) Yes (c) Yes	
AssetCloseTo	None	No	

Gtxn[N]: AppCallTx	AppCall from User		

Field	Restrictions	Checked?	Notes
Fee	None	No	This is up to the sender (which cannot be a bootstrapped pool)

Sender	User address, which must be the same as a. the sender of the Gtxn[N-2] txn (if applicable) b. the sender of the Gtxn[N-1] txn c. the receiver of the itxn[0] txn	(a) Yes (b) Yes (c) Yes	Cannot be the pool's address by design
TxType	AppCall	Yes	
RekeyTo	None	No	
Application ID	Approval App ID	Yes	
OnComplete	NoOp	Yes	

Accounts	1: Pool address, which must be
	   a. the address of a valid bootstrapped pool
	   b. the same as the receiver of Gtxn[N-2] (if applicable)
	   c. the same as the receiver of Gtxn[N-1]
	   d. the sender of itxn[0]
		(a) Yes
		(Implicitly)
		(b) Yes
		(c) Yes
		(d) Yes	

App Arguments	0: "add_liquidity"
	1: "flexible" or "single"
	   a. can only be either "flexible" or "single"
	   b. if "flexible", then both Gtxn[N-2] and Gtxn[N-1] must be valid asset/algo transfers
	     Otherwise, only Gtxn[N-1] must be a valid asset/algo transfer
	2: min_output: can be any value
		0: Yes
		1: (a) Yes
		   (b) Yes
		2:No	

Foreign Apps	None	No	
Foreign Assets	0: pool_token_asset_id The asset ID must be the token asset of the pool contract	Yes (implicitly)	Inner txns would fail if this id doesn't match the pool id

itxn[0]: AssetTransferTx	Transfer Pool Token to User from Pool		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	must be 0	Yes	
Sender	Pool address, which must be equal to - the receiver of Gtxn[N-2] (if applicable) - the receiver of Gtxn[N-1] - Gtxn[N].Accounts[1]	Yes	
TxType	Axfer	Yes	
RekeyTo	No rekey	Yes	
XferAsset	Must be the pool's token asset ID	Yes	
AssetAmount	A value computed by the logic - non-zero - >= min_output	Yes	

AssetSender	No AssetSender	Yes	
AssetReceiver	User address, which must be the same as - the sender of the Gtxn[N-2] txn - the sender of the Gtxn[N-1] txn - the sender of the Gtxn[N] txn	Yes	
AssetCloseTo	No AssetCloseTo	Yes	
Other Restrictions			
	Restrictions	**Checked?**	**Notes**
	Pool lock is 0	Yes	
	Pool was already initialized (issued pool tokens is positive)	Yes	

Gtxn[N-1]: Transfer Pool Token to Pool from User			
Gtxn[N]: AppCall from User			
itxn[0]: Transfer Asset 1 to User from Pool			
itxn[1]: Transfer Asset 2 to User from Pool			
OR			
itxn[0]: Transfer Asset {1 or 2} to User from Pool			

Gtxn[N-1]: AssetTransferTx	Transfer Pool Token to Pool from User		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	None	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	User address, which must be the same as - the sender of the Gtxn[N] txn - the receiver of the itxn[0] txn - the receiver of the itxn[1] txn (if applicable)	Yes	Cannot be a Pool's address by design
TxType	Axfer, must be checked by Gtxn[N]	Yes	
RekeyTo	None	No	
XferAsset	Must be the pool token asset of this Pool	Yes	
AssetAmount	None (could be zero)	No	
AssetSender	None	No	
AssetReceiver	Pool address, which must be equal to - Gtxn[N].Accounts[1] - the sender of itxn[0] - the sender of itxn[1] (if applicable)	Yes	
AssetCloseTo	None	No	

Gtxn[N]: AppCallTx	AppCall from User		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	None	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	User address, which must be the same as a. the sender of the Gtxn[N-1] txn b. the receiver of the itxn[0] txn c. the receiver of the itxn[1] txn (if applicable)	Yes	Cannot be the pool's address by design

TxType	AppCall	Yes	
RekeyTo	None	No	
Application ID	Approval App ID	Yes	
OnComplete	NoOp	Yes	

Accounts	1: Pool address, which must be
	   a. the address of a valid bootstrapped pool
	   b. the receiver of Gtxn[N-1]
	   c. the sender of itxn[0]
	   d. the sender of itxn[1] (if applicable)
		(a) Yes
		(Implicitly)
		(b) Yes
		(c) Yes
		(d) Yes	

App Arguments	0: "remove_liquidity" 1: min_asset_1_out => None (could be zero) 2: min_asset_2_out => None (could be zero)	0: Yes 1 & 2: No	
Foreign Apps	None	No	
Foreign Assets	0: asset_1_id 1: asset_2_id - The asset IDs must match the ones given in the pool contract	Yes (implicitly)	Inner txns would fail if these ids don't match the pool ids

itxn[0]	Transfer Asset1 to Pool from User (OR transfer Asset {1 or 2} to User from Pool)		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	0	Yes	
Sender	Pool address, which must be equal to - the receiver of Gtxn[N-1] - Gtxn[N].Accounts[1] - the sender of itxn[1] (if applicable)	Yes	Cannot be a Pool's address by design
TxType	Axfer, if two assets, or either Axfer or Pay if one asset. - must be checked by Gtxn[N]	Yes	
RekeyTo	No Rekey	Yes	
XferAsset	Must be A1_ID of this Pool if two assets requested Otherwise, must be either A1_ID or A2_ID - must be checked by Gtxn[N]	Yes	
AssetAmount	Non-zero value computed by the logic	Yes	
AssetSender	No AssetSender	Yes	

Field	Restrictions	Checked?	Notes
AssetReceiver	User address, which must be the same as - the sender of the Gtxn[N-1] txn - the sender of the Gtxn[N] txn - the receiver of the itxn[1] txn (if applicable)	Yes	
AssetCloseTo	No AssetCloseTo	Yes	
itxn[1]	Transfer Asset2 (Algo) to Pool from User		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	None	Yes	
Sender	Pool address, which must be equal to - the receiver of Gtxn[N-1] - Gtxn[N].Accounts[1] - the sender of itxn[0]	Yes	
TxType	Pay (if asset is Algo)	Yes	
RekeyTo	No Rekey	Yes	
Receiver	User address, which must be the same as - the sender of the Gtxn[N-1] txn - the sender of the Gtxn[N] txn - the receiver of the itxn[0] txn	Yes	
Amount	Non-zero value computed by the logic	Yes	
CloseRemainderTo	No CloseRemainderTo	Yes	
OR			
itxn[1]	Transfer Asset2 (non-Algo) to Pool from User		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	None	Yes	
Sender	Pool address, which must be equal to - the receiver of Gtxn[N-1] - Gtxn[N].Accounts[1] - the sender of itxn[0]	Yes	Cannot be a Pool's address by design
TxType	Axfer (if asset is non-Algo)	Yes	
RekeyTo	No Rekey	Yes	
XferAsset	User address, which must be the same as - the sender of the Gtxn[N-1] txn - the sender of the Gtxn[N] txn - the receiver of the itxn[0] txn	Yes	

AssetAmount	Non-zero value computed by the logic	Yes	
AssetSender	No AssetSender	Yes	
AssetReceiver	User address, which must be the same as - the sender of the Gtxn[N-1] txn - the sender of the Gtxn[N] txn - the receiver of the itxn[0] txn	Yes	
AssetCloseTo	No AssetCloseTo	Yes	
Other Restrictions			
	Restrictions	**Checked?**	**Notes**
	Pool lock is 0	Yes	

Gtxn[N-1]: Transfer Input Asset to Pool from User (A1_ID or A2_ID)	
Gtxn[N]: AppCall from User	
itxn[0]: Transfer Output Asset to User from Pool (A1_ID or A2_ID)	

Gtxn[N-1]: PayTx	Transfer Input Asset (Algo) to Pool from User		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	None	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	User address, which must be the same as - the sender of the Gtxn[N] txn - the receiver of the itxn[0] txn	Yes	Cannot be a Pool's address by design
TxType	Pay (only if input asset is Algo), the Gtxn[N] txn must check that A2_ID of the pool is 0	Yes	
RekeyTo	None	No	
Receiver	Pool address, which must be equal to - Gtxn[N].Accounts[1] - the sender of itxn[0]	Yes	
Amount	None (could be zero)	No	Would be best to reject the txn if this is zero
CloseRemainderTo	None	No	
OR			
Gtxn[N-1]: AssetTransferTx	Transfer Input Asset (ASA) to Pool from User		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	None	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	User address, which must be the same as - the sender of the Gtxn[N] txn - the receiver of the itxn[0] txn	Yes	Cannot be a Pool's address by design
TxType	Axfer (only if input asset is non-Algo)	Yes	
RekeyTo	None	No	
XferAsset	Must be either: - A1_ID, or - A2_ID	Yes	
AssetAmount	None (could be zero)	No	Would be best to reject the txn if this is zero
AssetSender	None	No	

| AssetReceiver | Pool address, which must be equal to
- Gtxn[N].Accounts[1]
- the sender of itxn[0] | Yes | |
| AssetCloseTo | None | No | |

Gtxn[N]: AppCallTx	AppCall from User		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	None	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	User address, which must be the same as the sender of the N-1 txn	Yes	Cannot be the pool's address by design
TxType	AppCall	Yes	
RekeyTo	None	No	
Application ID	Approval App ID	Yes	
OnComplete	NoOp	Yes	

Accounts	1: Pool address, which must be
	    a. the address of a valid bootstrapped pool
	    b. the same as the receiver address of N-1 txn
		(a) Yes (Implicitly)
		(b) Yes	

App Arguments	0: "swap" 1: mode value => must be "fixed_input" or "fixed_output" 2: min_output value => can be any value	0: Yes 1: Yes 2: No	
Foreign Apps	None	No	
Foreign Assets	0: asset_1_id 1: asset_2_id - The asset IDs must match the ones given in the pool contract	Yes (implicitly)	Inner txns would fail if these ids don't match the pool ids

itxn[0]: PayTx	Transfer Output Asset (Algo) to User from Pool		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	must be 0	Yes	
Sender	Pool address, which must be equal to - Gtxn[N].Accounts[1] - the receiver of the Gtxn[N-1] txn	Yes	
TxType	Pay, and - the input asset was A1_ID of the pool - the output asset id A2_ID is 0	Yes	
RekeyTo	No rekey	Yes	

Receiver	User address, which must be equal to: 1. The sender of N-1 txn 2. The sender of the app call	Yes	
Amount	None (could be zero)	No	Would be best to reject the txn if this is zero
CloseRemainderTo	No CloseRemainderTo	Yes	
OR			
itxn[0]: AssetTransferTx	Transfer Output Asset (ASA) to User from Pool		

Field	Restrictions	Checked?	Notes
Fee	must be 0	Yes	
Sender	Pool address, which must be equal to - Gtxn[N].Accounts[1] - the receiver of the Gtxn[N-1] txn	Yes	
TxType	Axfer (only if output asset is non-Algo)	Yes	
RekeyTo	No rekey	Yes	
XferAsset	Must be either: - A1_ID if the input asset was A2_ID, or - A2_ID if the input asset was A1_ID	Yes	
AssetAmount	None (could be zero)	No	Would be best to reject the txn if this is zero
AssetSender	No AssetSender	Yes	
AssetReceiver	User address, which must be equal to: 1. The sender of N-1 txn 2. The sender of the app call	Yes	
AssetCloseTo	No AssetCloseTo	Yes	

Other Restrictions

	Restrictions	Checked?	Notes
	Pool lock is 0	Yes	
	Input payment txn's index is N-1	Yes	

Gtxn[N]: Flash Loan AppCall from User	
itxn[0]: Transfer Asset 1 to User from Pool if Asset 1 is requested	
itxn[1]: Transfer Asset 2 to User from Pool if Asset 2 is requested	
...	
Gtxn[N+X-2]: Transfer Asset 1 to Pool (if it was requested)	
Gtxn[N+X-1]: Transfer Asset 2 to Pool (if it was requested)	
Gtxn[N+X]: Verify Flash Loan AppCall from User	

Gtxn[N]: AppCallTx	Flash Loan AppCall from User		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	None	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	User address, which must be the same as a. the receiver of itxn[0] and itxn[1] (as applicable) b. the sender of Gtxn[N+X-2] and Gtxn[N+X-1] (as applicable) c. the sender of Gtxn[N+X]	(a) Yes (b) Yes (Indirectly) (c) Yes	- Cannot be a pool's address by design
TxType	AppCall => must also be checked by Gtxn[N+X]	Yes	
RekeyTo	None	No	
Application ID	Approval App ID, which must be the same as the app ID of Gtxn[N+X]	Yes	
OnComplete	NoOp => must also be checked by Gtxn[N+X]	Yes	

Accounts	1: Pool address, which must be
	   a. the address of a valid bootstrapped pool
	   b. the same as the sender address of itxn[0] and itxn[1] (as applicable)
	   c. the same as the receiver address of Gtxn[N+X-2] and Gtxn[N+X-1] (as applicable)
	   d. the same as the Gtxn[N+X].Accounts[1]
		(a) Yes (Implicitly)
		(b) Yes
		(c) Yes
		(d) ~~No~~ Yes
			This issue was self-reported, and has been fixed in the latest commit. (d) is now checked.

App Arguments	0: "flash_loan" => must also be checked by Gtxn[N+X]
	1: index_diff => must be:
	   a. greater than 1
	   b. equal to index_diff of Gtxn[N+X]
	2: asset_1_amount
	3: asset_2_amount
	   a. the sum of these two amounts must be non-zero
	   b. can at most be equal to the reserves of the corresponding asset
		0: Yes
		1:
		  (a) No
		  (b) Yes
		2 & 3:
		  (a) Yes
		  (b) Yes
			- when index_diff == 0, txn fails since the first app arg is different in both txns
			- when index_diff == 1,
			  - if both out amounts are zero, txn fails due to a failing assert
			  - Otherwise, txn fails due to unexpected txn type
			
			Recommendation: check that the index_diff > 1

Foreign Apps	None	No	
Foreign Assets	0: asset_1_id 1: asset_2_id - The asset IDs must match the ones given in the pool contract	Yes (implicitly)	Inner txns would fail if these ids don't match the pool ids

The Following covers the two cases of itxn[0] and itxn[1], if one asset or both assets are requested.			

itxn[i]	Transfer Asset i (Algo) to User from Pool if Asset i is requested		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	0	Yes	
Sender	Pool address, which must be the same as the Gtxn[N]. Accounts[1]	Yes	
TxType	Pay (only if input asset is Algo) a. A2_ID must be zero	Yes (implicitly)	
RekeyTo	No rekey	Yes	
Receiver	User address, which must be the sender of Gtxn[N]	Yes	
Amount	Non-zero value and <= pool reserves of the asset	Yes	
CloseRemainderTo	No CloseRemainderTo	Yes	
OR			
itxn[i]	Transfer Asset i (non-Algo) to User from Pool if Asset i is requested		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	0	Yes	
Sender	Pool address, which must be the same as the Gtxn[N]. Accounts[1]	Yes	Cannot be a Pool's address by design
TxType	Axfer (only if input asset is non-Algo)	Yes	
RekeyTo	No rekey	Yes	

XferAsset	Must be either A1_ID or A2_ID of this Pool (and non-zero)	Yes (implicitly)	
AssetAmount	Non-zero value <= pool reserves of the asset	No	
AssetSender	No AssetSender	Yes	
AssetReceiver	User address, which must be the sender of Gtxn[N]	Yes	
AssetCloseTo	No AssetCloseTo	Yes	

The Following covers the two cases of Gtxn[N+X-2] and Gtxn[N+X-1], if one asset or both assets were requested.

Gtxn[N+X-i]	Transfer Asset i (Algo) to Pool from User if Asset i is requested		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	None	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	User address, which must be the same as a. the receiver of itxn[0] and itxn[1] (as applicable) b. the sender of Gtxn[N+X-2] and Gtxn[N+X-1] (as applicable) c. the sender of Gtxn[N+X] and Gtxn[N]	(a) Yes (Indirectly) (b) Yes (Indirectly) (c) Yes	

TxType	Pay (only if borrowed asset was Algo)
	   a. A2_ID must be zero
	   b. Borrow asset was Algo
		Yes	

RekeyTo	None	No	
Receiver	Pool address, which must be the same as the Gtxn[N+X].Accounts[1] and Gtxn[N].Accounts[1]	Yes	
Amount	Non-zero value >= amount borrowed + fee	Yes (Indirectly)	
CloseRemainderTo	None	No	
OR			
Gtxn[N+X-i]	Transfer Asset i (non-Algo) to Pool from User if Asset i is requested		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	None	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	User address, which must be the same as a. the receiver of itxn[0] and itxn[1] (as applicable) b. the sender of Gtxn[N+X-2] and Gtxn[N+X-1] (as applicable) c. the sender of Gtxn[N+X] and Gtxn[N]	(a) Yes (Indirectly) (b) Yes (Indirectly) (c) Yes	

TxType	Axfer (only if borrowed asset was non-Algo)	Yes	
RekeyTo	None	No	
XferAsset	Must be 1. either A1_ID or A2_ID of this Pool (and non-zero) 2. must be equal to borrow asset ID	Yes	
AssetAmount	Non-zero value >= amount borrowed + fee	Yes (Indirectly)	
AssetSender	None	No	
AssetReceiver	Pool address, which must be the same as the Gtxn[N+X].Accounts[1] and Gtxn[N].Accounts[1]	Yes	
AssetCloseTo	None	No	

Gtxn[N+X]: AppCallTx	Verify Flash Loan AppCall from User		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	None	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	User address, which must be the same as a. the receiver of itxn[0] and itxn[1] (as applicable) b. the sender of Gtxn[N+X-2] and Gtxn[N+X-1] (as applicable) c. the sender of Gtxn[N]	(a) Yes (Indirectly) (b) Yes (c) Yes	Cannot be the pool's address by design
TxType	AppCall => must also be checked by Gtxn[N]	Yes	
RekeyTo	None	No	
Application ID	Approval App ID, which must be the same as the app ID of Gtxn[N]	Yes	
OnComplete	NoOp => must also be checked by Gtxn[N]	Yes	

Accounts	1: Pool address, which must be
	    a. the address of a valid bootstrapped pool
	    b. the same as the sender address of itxn[0] and itxn[1] (as applicable)
	    c. the same as the receiver address of Gtxn[N+X-2] and Gtxn[N+X-1] (as applicable)
	    d. the same as the Gtxn[N].Accounts[1]
		(a) Yes (Implicitly)
		(b) Yes
		(c) Yes
		(d) ~~No~~ Yes
			This issue was self-reported, and has been fixed in the latest commit. (d) is now checked.

App Arguments	0: "verifiy_flash_loan": must also be checked by Gtxn[N]
	1: index_diff: must be:
	   a. greater than 1
	   b. equal to index_diff of Gtxn[N]
		0: Yes
		1:
		   (a) No
		   (b) Yes
			- when index_diff == 0, txn fails since the first app arg is different in both txns
			- when index_diff == 1,
			   - if both out amounts are zero, no changes to state.
			   - Otherwise, txn fails since the app call txn would be expected to be a transfer txn.
			
			Recommendation: check that the index_diff > 1

Foreign Apps	None	No	
Foreign Assets	None	No	
Other Restrictions			
	Restrictions	**Checked?**	**Notes**
	Pool lock is 0	Yes	

Gtxn[N]: Flash Swap AppCall from User			
itxn[0]: Transfer Asset 1 to User from Pool if Asset 1 is requested			
itxn[1]: Transfer Asset 2 to User from Pool if Asset 2 is requested			
...			
Gtxn[N+X]: Verify Flash Swap AppCall from User			

Gtxn[N]: AppCallTx	Flash Swap AppCall from User		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	None	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	User address, which must be the same as 1. the receiver of itxn[0] and itxn[1] (as applicable) 2. the sender of Gtxn[N+X]	Yes	Cannot be the pool's address by design
TxType	AppCall => must also be checked by Gtxn[N+X]	Yes	
RekeyTo	None	No	
Application ID	Approval App ID, which must be the same as the app ID of Gtxn[N+X]	Yes	
OnComplete	NoOp => must also be checked by Gtxn[N+X]	Yes	

Accounts	1: Pool address, which must be
	  a. the address of a valid bootstrapped pool
	  b. the same as the sender address of itxn[0] and itxn[1] (as applicable)
	  c. the same as the Gtxn[N+X].Accounts[1]
		(a) Yes (Implicitly)
		(b) Yes
		(c) ~~No~~ Yes
			This issue was self-reported, and has been fixed in the latest commit. (c) is now checked.

App Arguments	0: "flash_swap" => must also be checked by Gtxn[N+X]
	1: index_diff => must be:
	  a. greater than 1
	  b. equal to index_diff of Gtxn[N+X]
	2: asset_1_amount
	3: asset_2_amount
	  a. the sum of these two amounts must be non-zero
	  b. can at most be equal to the reserves of the corresponding asset
		0: Yes
		1:
		  (a) No
		  (b) Yes
		2 & 3:
		  (a) Yes
		  (b) Yes (implicitly)
			- when index_diff == 0, txn fails since the first app arg is different in both txns
			- when index_diff == 1, txn fails since the pool invariant won't hold
			
			Recommendation: check that the index_diff > 1

Foreign Apps	None	No	

Foreign Assets	0: asset_1_id 1: asset_2_id - The asset IDs must match the ones given in the pool contract	Yes (implicitly)	Inner txns would fail if these ids don't match the pool ids

The Following covers the two cases of itxn[0] and itxn[1], if one asset or both assets are requested.

itxn[i]	Transfer Asset i (Algo) to User from Pool if Asset i is requested		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	0	Yes	
Sender	Pool address, which must be the same as the Gtxn[N]. Accounts[1]	Yes	
TxType	Pay (only if input asset is Algo) a. A2_ID must be zero	Yes (implicitly)	
RekeyTo	No rekey	Yes	
Receiver	User address, which must be the sender of Gtxn[N]	Yes	
Amount	Non-zero value and <= pool reserves of the asset	Yes	
CloseRemainderTo	No CloseRemainderTo	Yes	

OR

itxn[i]	Transfer Asset i (non-Algo) to User from Pool if Asset i is requested		
Field	**Restrictions**	**Checked?**	**Notes**
Fee	0	Yes	
Sender	Pool address, which must be the same as the Gtxn[N]. Accounts[1]	Yes	Cannot be a Pool's address by design
TxType	Axfer (only if input asset is non-Algo)	Yes	
RekeyTo	No rekey	Yes	
XferAsset	Must be either A1_ID or A2_ID of this Pool (and non-zero)	Yes (implicitly)	
AssetAmount	Non-zero value <= pool reserves of the asset	No	
AssetSender	No AssetSender	Yes	
AssetReceiver	User address, which must be the sender of Gtxn[N]	Yes	
AssetCloseTo	No AssetCloseTo	Yes	

Gtxn[N+X]: AppCallTx	Verify Flash Swap AppCall from User		
Field	**Restrictions**	**Checked?**	**Notes**

Fee	None	No	This is up to the sender (which cannot be a bootstrapped pool)
Sender	User address, which must be the same as 1. the receiver of itxn[0] and itxn[1] (as applicable) 2. the sender of Gtxn[N]	(a) Yes (Indirectly) (b) Yes (Indirectly)	Cannot be the pool's address by design
TxType	AppCall => must also be checked by Gtxn[N]	Yes	
RekeyTo	None	No	
Application ID	Approval App ID, which must be the same as the app ID of Gtxn[N]	Yes	
OnComplete	NoOp => must also be checked by Gtxn[N]	Yes	

Accounts	1: Pool address, which must be
	  a. the address of a valid bootstrapped pool
	  b. the same as the sender address of itxn[0] and itxn[1] (as applicable)
	  c. the same as the Gtxn[N].Accounts[1]
		(a) Yes (Implicitly)
		(b) Yes (Indirectly)
		(c) ~~No~~ Yes
			This issue was self-reported, and has been fixed in the latest commit. (c) is now checked.

App Arguments	0: "verifiy_flash_swap": must also be checked by Gtxn[N]
	1: index_diff: must be:
	  a. greater than 1
	  b. equal to index_diff of Gtxn[N]
		0: Yes
		1:
		  (a) No
		  (b) Yes
			- when index_diff == 0, txn fails since the first app arg is different in both txns
			- when index_diff == 1, txn fails since the pool invariant won't hold
			
			Recommendation: check that the index_diff > 1

Foreign Apps	None	No	
Foreign Assets	None	No	
Other Restrictions			

	Restrictions	Checked?	Notes
	For Gtxn[N], Pool lock is 0	Yes	
	For Gtxn[N+X], Pool lock is 1	Yes	

Notes:

1. We omit fields that are most likely irrelevant for this analysis, including common fields such as LastValid, GenesisHash, ... etc. We also exclude AppCall fields used only when creating apps, such as Approval Program and ExtraProgramPages.

2. We may later consider adding "Where are things checked?" -- line numbers perhaps, or maybe blocks

PayTx

Field	Restrictions	Checked?	Notes
Fee			
Sender			
TxType			
RekeyTo			
Receiver			
Amount			
CloseRemainderTo			

AssetConfigTx

Field	Restrictions	Checked?	Notes
Fee			
Sender			
TxType			
RekeyTo			
ConfigAsset			
AssetParamsTotal			
AssetParamsDecimals			
AssetParamsDefaultFrozen			
AssetParamsUnitName			
AssetParamsAssetName			
AssetParamsURL			
AssetParamsMetaDataHash			
AssetParamsManagerAddr			
AssetParamsReserveAddr			
AssetParamsFreezeAddr			
AssetParamsClawbackAddr			

AssetTransferTx

Field	Restrictions	Checked?	Notes
Fee			
Sender			
TxType			
RekeyTo			
XferAsset			
AssetAmount			
AssetSender			
AssetReceiver			
AssetCloseTo			

AssetFreezeTx

Field	Restrictions	Checked?	Notes

Fee			
Sender			
TxType			
RekeyTo			
FreezeAccount			
FreezeAsset			
AssetFrozen			
AppCallTx			
Field	**Restrictions**	**Checked?**	**Notes**
Fee			
Sender			
TxType			
RekeyTo			
Application ID			
OnComplete			
Accounts			
App Arguments			
Foreign Apps			
Foreign Assets			